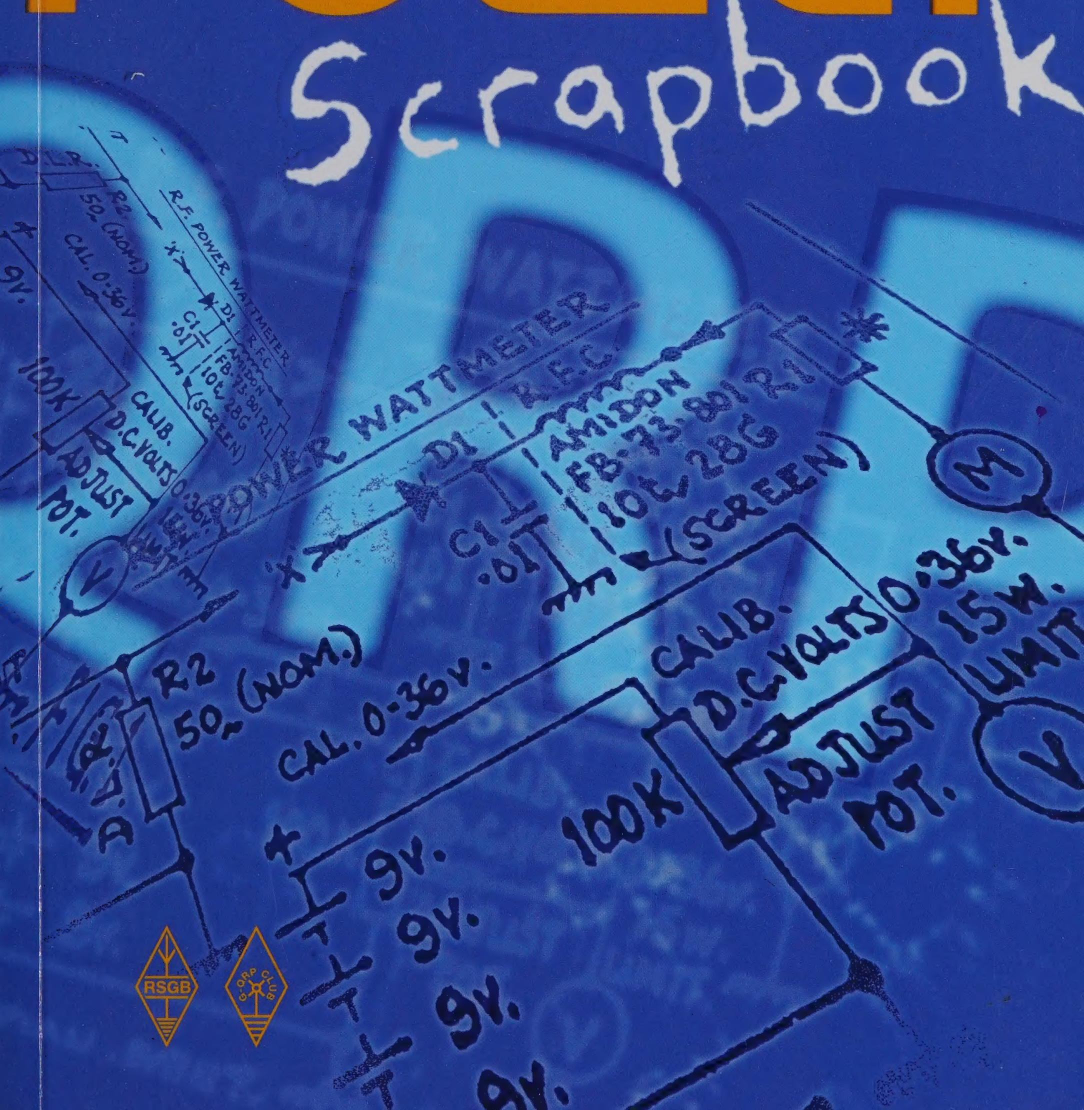
Low Power

Scrapbook



RSGB

G-QRP CLUB

The Low Power Scrapbook

Radio Society of Great Britain

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Preface

In 1974, I wrote a letter to the *Short Wave Magazine* asking for anyone interested in QRP operating and the construction of QRP equipment to contact me about the possible formation of a G QRP Club. Just over 30 people wrote to me, and in response I produced the first issue of *SPRAT*, the Journal of the G QRP Club. This was 8 pages copied on an old spirit duplicator at a local school. The name *SPRAT* came at the suggestion of Gordon, G3DNF. (Small Power Radio Amateur Transmission).

By the time of the second issue of *SPRAT* there were 60 members of the G QRP Club including five in the USA. The club now has over 5000 members worldwide. The G QRP Club exists to promote interest and growth in low power amateur radio communication (five watts or less). Membership is open to any licensed radio amateur or short wave listener anywhere in the world. *SPRAT* is published 4 times a year. The early issues of *SPRAT* had an A4 format and were hand produced up to issue 22. Issue 23 was the first in the now familiar A5 format that has now passed its 100th issue.

The editorial policy over the years has been to produce a club journal with two-thirds technical content and one-third news and events. Some of the best-known amateur radio authors in the world have contributed to *SPRAT* and it has provided an outlet for many other radio amateurs, who would never have been authors, to make their own technical contribution.

In 1983 the G QRP Club privately printed the *G QRP Club Circuit Handbook*, a compilation of articles from issue of *SPRAT* from 1975-1982. This has remained in print to the present day. *The Low Power Scrapbook* follows on from that time, being a compilation of the best articles in more recent years.

Like all *SPRAT* contributions, these articles reflect the best of a true amateur radio tradition of ‘doing technology’ in the home workshop or on the kitchen table. May you be inspired by the ideas you find here.

George Dobbs, G3RJV

Vorwort

Es war im Jahr 1974, als ich einen Leserbrief an das Short Wave Magazine schrieb und fragte, wer sich noch für QRP-Betrieb und Selbstbau von QRP-Funktechnik interessiert. Ich bat die Betreffenden, sich mit mir auch wegen der Gründung eines QRP Clubs in Verbindung zu setzen.

Etwas mehr als 30 Leute meldeten sich bei mir, und gewissermaßen als Antwort an alle habe ich die erste Ausgabe der SPRAT, der Zeitschrift des G-QRP-Clubs, zusammengestellt. Sie bestand aus acht Seiten, die auf einem alten Kopierer in einer Schule vervielfältigt wurden. Der Titel SPRAT war eine Idee von Gordon, G3DNF, und steht für Small Power Radio Amateur Transmission.

Die zweite Ausgabe erhielten dann schon 60 Mitglieder des G-QRP-Clubs, unter ihnen auch 5 Amerikaner. Jetzt hat der Club mehr als 5000 Mitglieder in aller Welt. Der G-QRP-Club hat sich zum Ziel gesetzt, das Interesse am Amateurfunk mit kleinen Leistungen, also mit 5 W oder weniger, zu fördern und zu entwickeln. Die Mitgliedschaft im Club steht Funkamateuren aller Lizenzklassen und auch SWLs in allen Ländern offen.

Die SPRAT erscheint viermal jährlich. Während die ältesten Ausgaben bis zur Nr. 22 per Hand im A4-Format zusammengestellt wurden, hat sie ab Ausgabe Nr. 23 das heutige A5-Format. Und es sind bereits über 100 Ausgaben gedruckt worden.

In all den Jahren verfolgte die Redaktion das Ziel, ein Clubjournal mit zwei Dritteln technischem Inhalt und einem Drittel Nachrichten und Veranstaltungen zu gestalten. Einige der bekanntesten Amateurfunkautoren weltweit konnten für die Mitarbeit an der SPRAT gewonnen werden. So stellt die Zeitschrift ein Betätigungsfeld für viele andere Funkamateure dar, die nie zuvor Autoren waren, und nun ihre technischen Beiträge zugeliefert haben.

1983 hat der G-QRP-Club in Eigenregie das G-QRP-Circuit-Handbook als Zusammenfassung der interessantesten Artikel aus den Jahren 1975 bis 1982 gedruckt. Das ist auch heute noch erhältlich. Das Low Power Scrapbook stellt den Anschluß dar und ist eine Zusammenstellung der besten Artikel aus der jüngeren Zeit.

Wie alle SPRAT-Beiträge widerspiegeln sie das Beste aus einer echten Tradition der Funkamateure, nämlich in der eigenen Werkstatt oder auf dem Küchentisch etwas selbst zu bauen. Sie sollten sich von den Ideen, die Sie in diesem Buch finden, inspirieren lassen.

George Dobbs, G3RJV

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An 'RJV Twenty Project

DESIGN AND BUILD A TRANSCEIVER FOR THE 20M. BAND USING NO MORE THAN 20 COMPONENTS IN THE TRANSMITTER AND 20 COMPONENTS IN THE RECEIVER AND SUBMIT A LOG OF 20 DXCC COUNTRIES WORKED WITH THE EQUIPMENT....
(A COMPETITION TO MARK TWENTY YEARS OF THE G3RJV CALLSIGN)

THE WEE RIG

George Burt GM3OXX

After having built The Super OXO as an entry for The RJV 20/20 Award, it was decided to have a go at a VFO rig. The circuit was originally designed using grounded gate fets in the double and driver, but it was obvious that no way was there going to be enough drive to turn on the PA. So the circuit of The Wee Rig was the result.

The oscillator uses a BF 256LA Fet on 7.0 - 7.050 MHz, the tap on L1 is adjusted to turn on the BC108 doubler and should be found by trial, but keep it as low as possible other wise stability and pulling will be poor.

A grounded base BC108 is used as a doubler and is biased by the RF from the oscillator, this in turn, turns on the BC108 driver and this provides enough drive to run the PA at two watts input. It is possible to run much more power by increasing the tap on L1 or using a hotter driver, i.e. a ZTX82 drove the PA to three watts input (QRO!), so BC108s are used in most places.

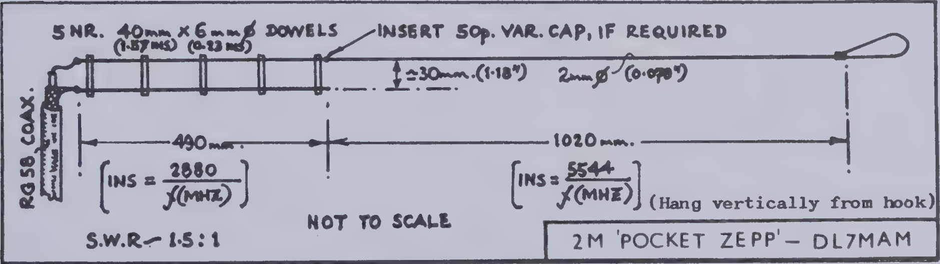
In the PA base the 220uF capacitor has a reactance of approximately 50 ohms, also the coil in the MD108 provides the base choke return.

When using the lash up, no band set capacitor was used, and the keying transistor was left out and the PA supply was keyed by a reed switch in the keyer. The PA is a small computer switching transistor, but any small PA device would suit.

A single pi network is switched between the PA and the receiver MD108, the 220uF capacitors in the pi network and driver are the small ceramic plate type.

The receiver is just an MD108 with a two stage DC coupled audio amplifier, with high impedance headphones. In its lash up form nearly 20 countries were worked in two days,

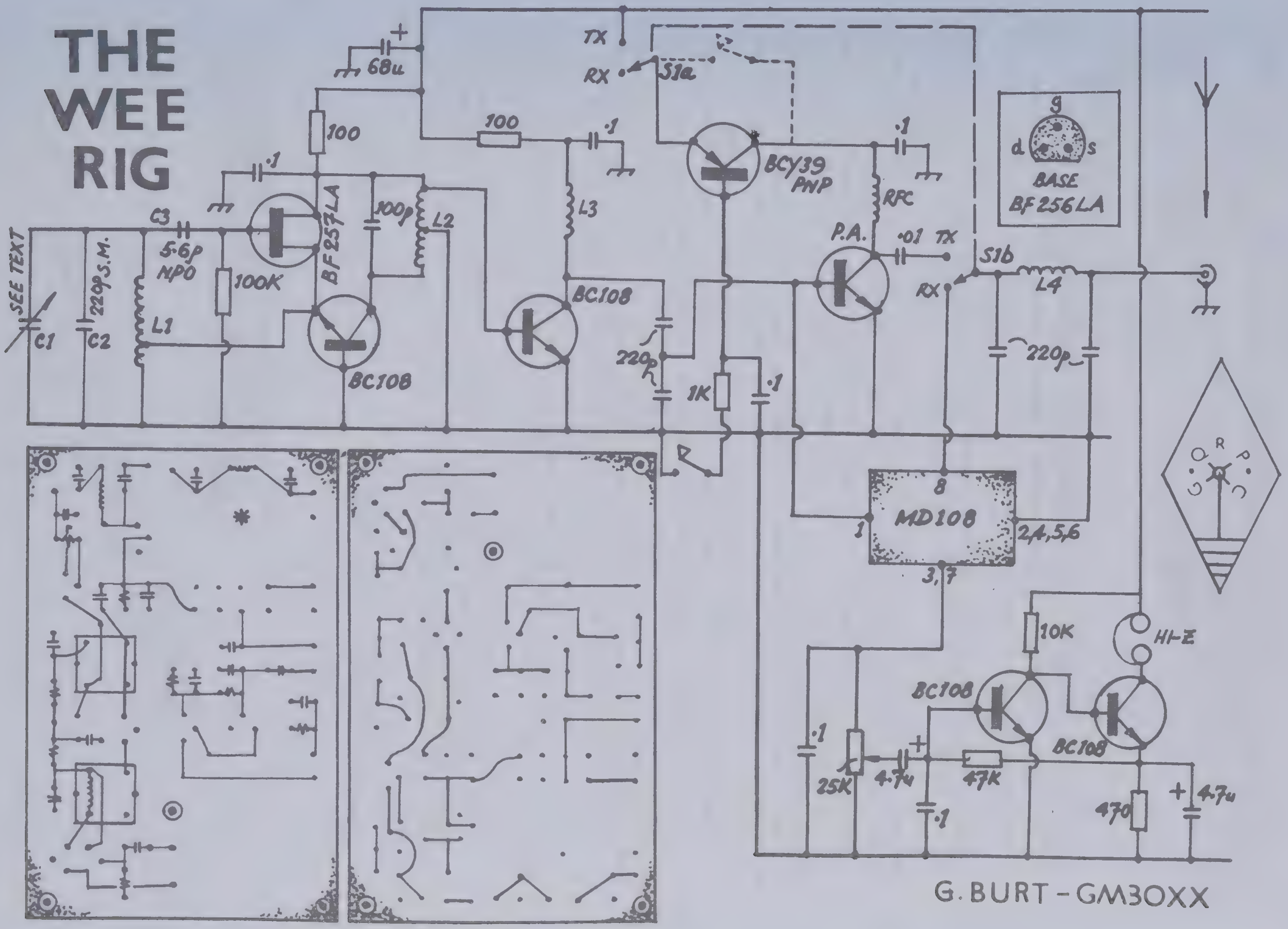
It would of course be easy to add RIT and Audio filtering, also it would be easy to move to most bands, and would make a nice simple transceiver for 10MHz.



2M 'POCKET ZEPP' – DL7MAM

I have had good results from this antenna hanging vertically from a tree on 2m. FM /P.
(G3RJV)

THE WEE RIG



G. BURT - GM3OXX

18/24MHz Version of the Lagos QRPeter

Ha-Jo Brandt DJ1ZB

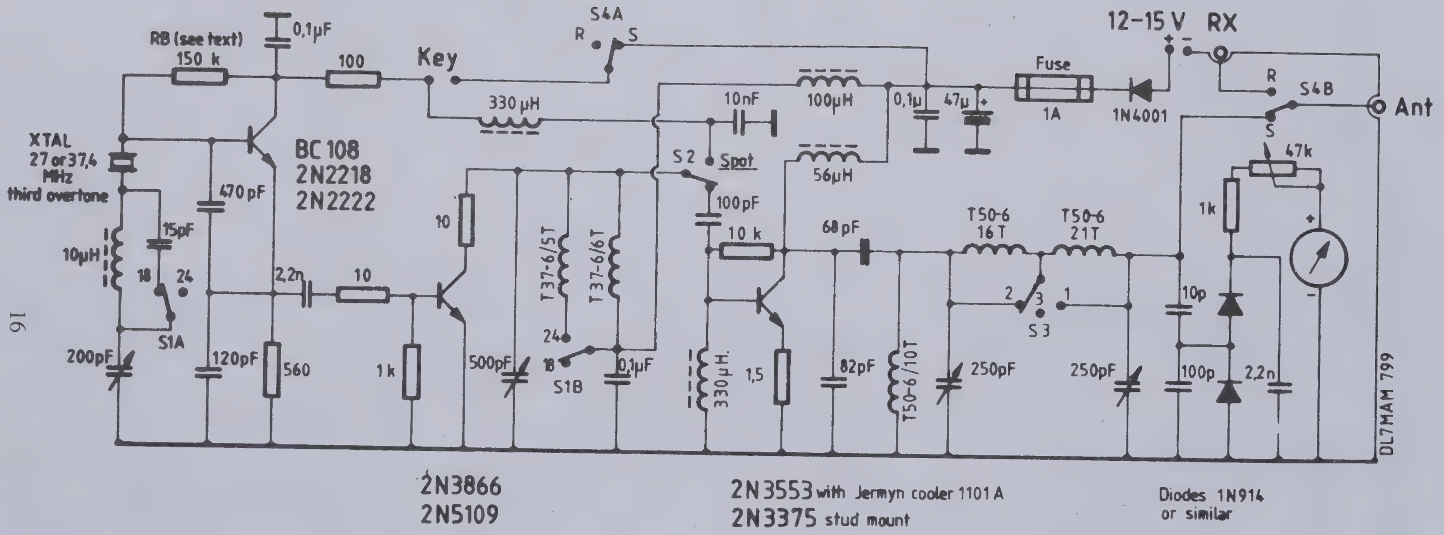
The Lagos QRPeter, originally designed as a single band transmitter for either 14, 21 or 28MHz (SPRAT, Summer 1980), was modified later to work on 14 and 21MHz because these bands offered most reliable QRP communication between Southern DL and The U.K. With the opening of The WARC bands in DL, a separate transmitter was built for 10MHz, whilst the two band Lagos was converted to 18 and 24MHz.

VYO and Crystals - As proposed in the original Lagos article, 27MHz CB crystals are used in their fundamental mode and doubled to 18MHz. No attempts were made to maximise the tuning range of the VXO, because the crystals are easily available spaced 10KHz at 27MHz. With a 10uH molded RF choke in parallel with a 15pF, the tuning range was more than 20KHz, so five crystals between 27135 and 27255 are needed to cover the band. Luckily a similar solution had been found for 24MHz. Two sources in DL are offering HC 25U third overtone crystals around 37.4MHz, also spaced every 10KHz, which are also excited in the fundamental mode and doubled to 24.9MHz. In this case, the VXO coil is operated without a parallel capacitor (S1A). Five crystals between 37370 and 37490KHz are needed to cover the band. As usual in this circuit, VXO resistor RB is selected to set the drive level to the doubler and PA stages.

Doubler Stage - First it was tried to tune 18 to 24MHz without switching, but parametric oscillations were noted on the higher band. To avoid this a high loaded Q must be maintained in the doubler resonant circuit. Therefore, a relative high variable C setting and separate coils for each band are used. A miniature DPDT switch can be employed to switch the VXO and doubler stage (S1A and S1B). In the 'Spot' position, switch S2 detunes the doubler output and also feeds supply voltage to the VXO. A substitute load such as in the 10MHz transmitter (Sprat, Summer 1982) is not necessary because the tuning range of the VXO is much less, and its stability better than in the 10MHz version.

PA Stage - The only switch in the PA stage (S3) is a miniature switch with a third open position to provide three values of inductivity in the PA tank. Position 1 is for low impedance loads at 24MHz, position 2 for high impedance loads at 24MHz and low impedance loads at 18MHz, and position 3 is for high impedance loads at 18MHz. Therefore coax fed aerials can be tuned as well as high impedance long wires or windoms. This solution was chosen because tapping a torodial coil would lower its unloaded Q and short-circuiting a toroid between tap and free end would severely deteriate its unloaded Q. This solution ensures high unloaded Q and low matching losses in all switch positions. For good power output (two watts RF), especially at 24.9MHz, a 2N3866 or 2N5109 is recommended in the doubler stage, and a well cooled 2N3553 or its stud mount version the 2N3375 in the PA stage. The VXO transistor is not critical.

Receiving the WARC Bands - The author has used the Kenwood R1000 receiver in several QSOs on 10, 18 and 24MHz. This receiver is quite suitable for this purpose, if a preselector (mandatory) and an audio filter are added. The 24MHz band is practically free and CW activity concentrating between 24890 and 24900KHz. 18MHz is still extensively used by commercial stations, and amateur activity is distributed on free spots between 18100 and 18125KHz or at the lower band edge.

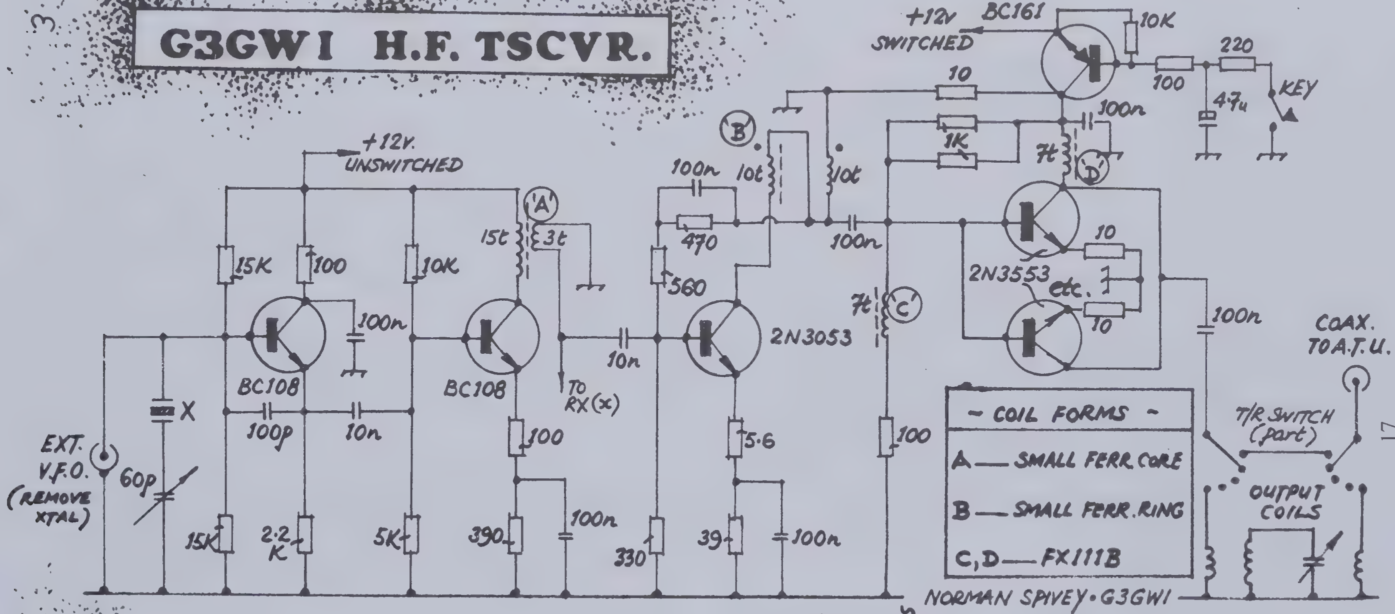


LAGOS QRPeter 18/24 MHz TWO-BAND-VERSION

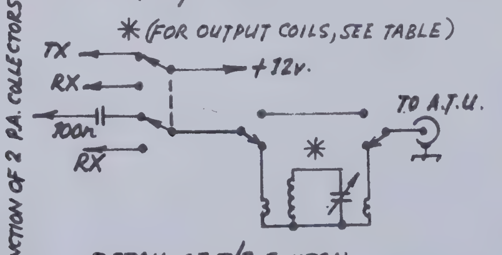
DJ1ZB

3

G3GWI H.F. TSCVR.

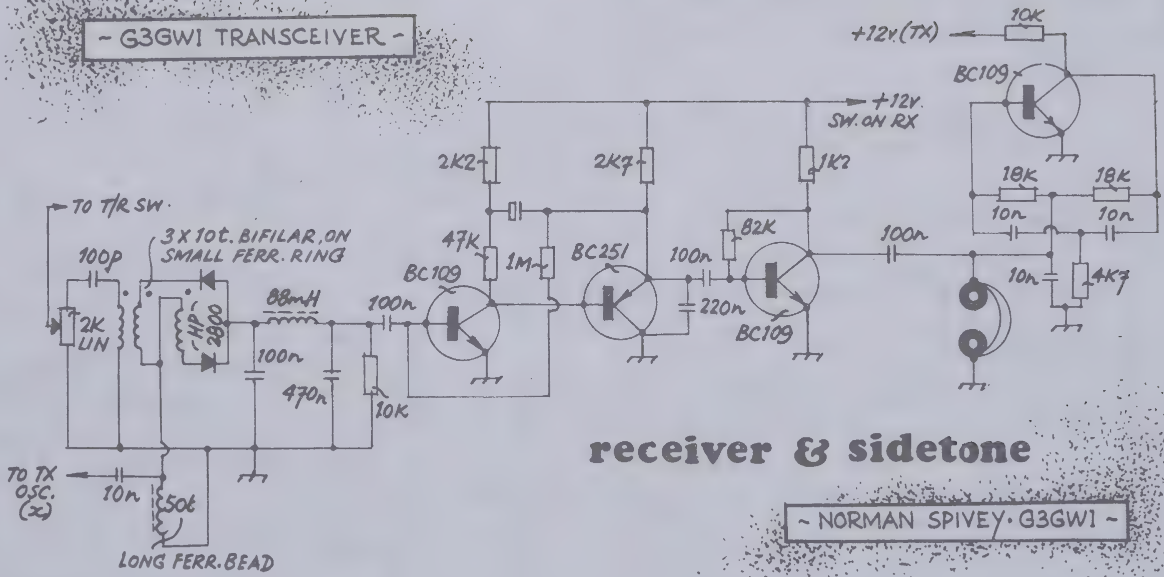


QRG	'L'uH	'Q'	turns	link	CORE	TRIM.	FIXED CAP.
3.5	3.125	6	25	10t	T50-2	140p	500p
7.0	2	6	20	8t	DO.	DO.	100p
14	1.13	6	17	6t	T50-6	DO	–
21	0.75	6	14	5t	DO	100p	–


JUNCTION OF 2 P.A. COLLECTORS
✱ (FOR OUTPUT COILS, SEE TABLE)
TX
RX
+12v.
100n
RX
✱
TO A.T.U.

DETAIL OF T/R SWITCH

~ G3GWI TRANSCEIVER ~



receiver & sidetone

~ NORMAN SPIVEY · G3GWI ~

THE G3GWI H.F. TRANSCEIVER By Norman Spivey, G3GWI

The transceiver is broadband and my original idea was to keep the tuning external to maintain sensativity. However, as room was available in the box I included four PA/receiver input tuned circuits, but have kept one switch position for straight through operation to enable the ATU to be used for tuning, or perhaps half-wave filters to be used instead of the link coupled parallel tuning.

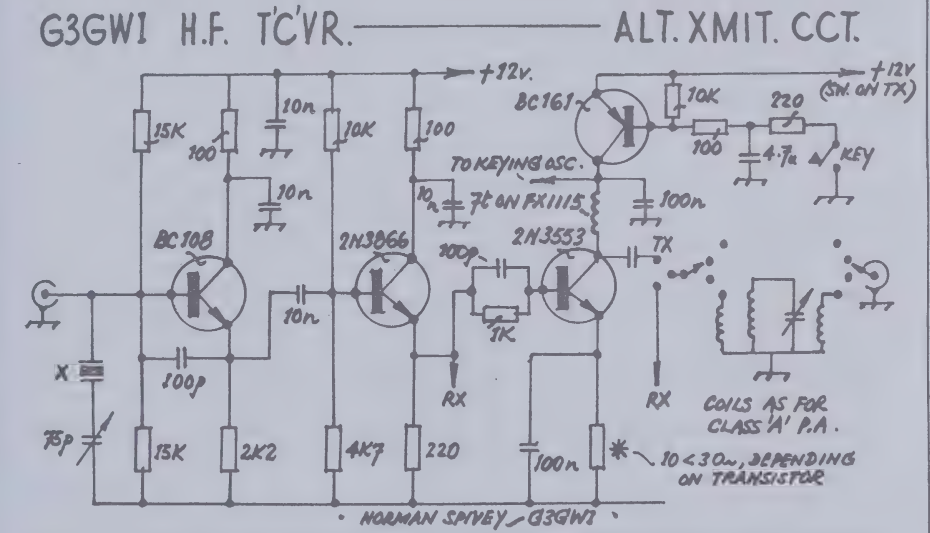
The extra components required to build the Class A PA are well worth the clear signal produced and the circuit works without the usual changing of components to obtain optimum performance, so the pristine appearance of the newly wired vero pin/5Rph is maintained.

The PA takes 200mA which represents an input of two watts (at ten volts), and the driver draws 50mA. Heat sinks are required on both PA transistors and the driver, though all three feel 'pleasantly' but not excessively warm in use.

The use of a Class A PA has changed my views on the issue whether input power or RF out should be the criteria for contests etc. I feel sure that all QRPers are environmentalists and perhaps clear signals are more important than efficiency at these power levels, particularly with boraodband PAs.

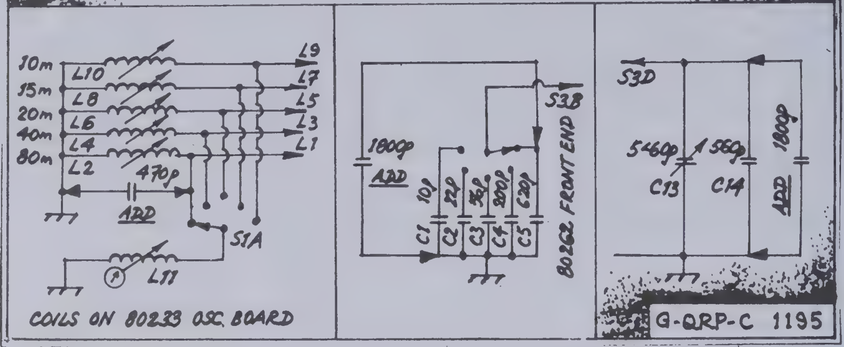
This unit is useful in that as it stands it can be used for /P work, yet by feeding in the output from a VFO on the appropriate frequency, perhaps fitted with RIT, full use as a home station is possible. DSB could be injected as with the 'Bren', though my own interest is CW, so development along these lines is not contemplated.

The transceiver is housed in a 10 x 4 x 3 inches box brought for a £1 at a rally. Each unit is wired on a 5 x 2 inches piece of 0.15" 5RPB pin board using beco pins and fitted back to back on a similar sized piece of aluminium screen, as in 'The Ebor'. All the other components are mounted alongside this on the front panel.



This is an alternative Transmit section based upon the GM3OXX OXO circuit. An extra stage is required to drive the detector and two receiver component changes are needed: The capitor feeding the RF to the detector changed to 62p (not 10n), the detector coil is now 3 x 5t. on a small ferrite toroid,trifilar wound. It runs 1W with ease but the PA emitter resistor can be adjusted to suit.

CONVERTING THE 'ARGONAUT' TO 160M. ———— SM6AOQ



Midnight the 1st of April 1982, was a remarkable moment for Amateur Radio in Sweden. A small part of the top band was then released for SM-stations for the first time after World War II. When I got the first news some two weeks before "zero", I looked around in my shack to see if there was anything I could possibly modify in a simple way for the new band. The Ten Tec Argonaut might be the right choice for a solder exercise, I thought.

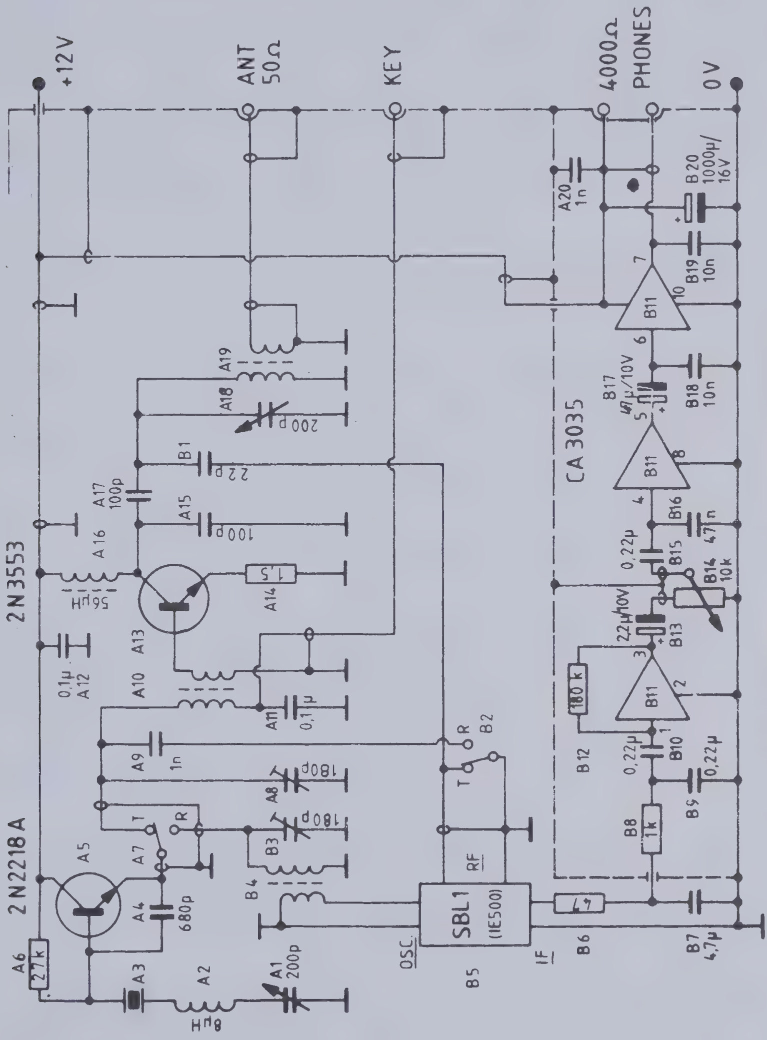
I examined the diagram and found, that the final stage should be broad enough, the manufacturer claims, that it works properly down to 1.5 MHz. The circuit between mixer and driver looks more like a low pass filter (that is on eighty of course), and would probably operate even at lower frequencies without modifications. Apparently, the only thing we have to do to get the transmitter on the air on top band is to change the VFO frequency.

The Argonaut is a single conversion affair, and there is no premixing of the VFO frequency, which makes it simple. On 80 meters the VFO frequency is doubled from 6.25 - 6.4 MHz to 12.5 - 12.8 MHz. In order to get output around 1.8 MHz, we have to lower VFO frequency to about 5.4 MHz resulting in 10.8 MHz after doubling. The most simple way to do that, turned out to be a capacitor across the tuning coil, and with 470 pF the "Swedish" portion of the band (1.83 to 1.845) came right in the middle of the scale between .30 and .31. The band pass filter in the VFO has to be slightly retuned, and just a few degrees of turning on the two trimmer capacitors will give enough injection signal to the mixer. Check the signal voltage at 10.83 MHz and 12.8 MHz which is the lowest and highest frequency the band pass filter should work on. Even if the HF-voltage is slightly lower at these edges than the manufacturer recommend, the mixers will certainly work properly. With a test with dummy load I got about 2 Watts of output, and frequency turned out to be correct. Consider that the built in low pass filter will let the 2nd harmonic pass through, so an extra low pass filter is advisable. However, I had an "on the air" test with my friend SM6ZN who supposedly have an accurate S-meter, and the 2nd harmonic on 80 was about 40 dB down in comparison with the fundamental 160 m signal without any extra low pass filter.

To get the receiver on 160, the resonance has to be changed in the front end circuits. In the Argonaut the tuning on different bands is performed by changing the inductance with the cores in the coils in combination with a change of circuit capacitance with the band switch, thus getting the same L/C relationsship on all bands. This would require double value of both the inductance and capacitance in the eighty meter position to get on 160 maintaining correct L/C. A rough method is to make the capacitance four times the value on eighty, which means an additional capacitor of about 1800 pF in parallell with the exsisting one. The L/C relationsship will not be correct of course, but the performance is good enough for reception of most signals.

G3RJV TWENTY COMPETITION

DESIGN AND BUILD A TRANSCEIVER FOR THE 20M. BAND USING NO MORE THAN 20 COMPONENTS IN THE TRANSMITTER AND 20 COMPONENTS IN THE RECEIVER AND SUBMIT A LOG OF 20 DXCC COUNTRIES WORKED WITH THE EQUIPMENT....
(A COMPETITION TO MARK TWENTY YEARS OF THE G3RJV CALLSIGN)



DJ 1 ZB's TWINNYSET

THE TWINNYSET TRANSCEIVER By Ha-Jo Brandt, DJ1ZB

DJ1ZB's solution for The RJV Twenty Trophy. (In the dialect spoken along The North Sea coast of Germany, where the author lived during High Scool, Twinny means Twenty.)

Design Guidelines - It was a real challenge to design a transceiver with so few parts which had to be useful in practice. From the begining, a direct conversion concept was regarded the only solution for the receiver section. Experience gained with The HW7 indicated that the mixer should be balanced to minimize AM detection, but all the configurations using mixer ICs or the CA3046 array would have needed too many parts. Besides this, there would be no parts left for a good receiver preselector, so a mixer with a large dynamic range seemed necessary. Finally a diode ring mixer was chosen, remembering W7EL's "Optimized QRP Transceiver" (See Sprat Autumn 1980 and QST August 1980), and the use of the SBL-1 mixer in The "Bren" (See Sprat Autumn 1981).

Without any amplification in or ahead of the mixer, a three stage AF amplifier was needed for high impedance headphones (4000 ohms). The CA3035, not too popular but well known to all HW7 owners and still in the RCA programme, offered the necessary amount of amplification with the least number of external parts.

For the transmitter section, a VFO was tried on paper, but too many parts would have been needed, leaving too few for the buffer and PA design. A VXO-PA was the final choice, using the 2N3553 in the PA to achieve maximum output with minimum drive, as in The Lagos QRPeter (See Sprat Summer 1980).

The Circuit - All components are designated with the letter A for the transmitter and B for the receiver section. A5 is the VXO transistor. The emitter circuit A8 - A10 is adjusted for best PA drive, but must remain on the capacitive side of resonance to sustain oscillations. The PA tank is tuned by A18 for best output to a 50 ohms load. VXO excitation may be controlled by varying A6. Keying is accomplished in the emitter path of the VXO (about 20mA). PA emitter current is limited by the data sheet to 330 mA (0.5 volt at PA emitter resistor. The 2N3375 with 0.5A current limit may also be used).

If A8 is not adjusted properly, the transmitter may show parasitic oscillations. Therefore the output should be checked by a separate receiver, or by a dummy load connected to a video detector and an oscilloscope. The scope must show pure DC voltage, perhaps some residual RF, but no low frequency oscillations.

During receive, the circuit B3-B4 is connected to the VXO, feeding the mixer local oscillator port (0.5 to 1 volt). By listening to a separate receiver B3 is adjusted so that the VXO frequency is the same as in transmit operation, preferably slightly detuned by 500 to 1000Hz so a beat note will be produced if transmit and receive frequencies are exactly the same. A station must be tuned in on the right side of zero beat of course, as with the original HW8.

During transmit the mixer input is short circuited by B2. In the receive position the PA tank serves as a broad preselector. Resonant circuit A8-A10 must be detuned from resonance to prevent reception via A13 and the oscillator input.

B6 represents the IF output termination of the mixer for all RF frequencies, and in combination with B7 forms the first section of an RC low pass filter with a cut off point of about 700Hz. As the pin 1 input impedance of the CA3035 is rather high a good macth cannot be obtained here (in contrast with W7EL's receiver). However, this allows the second RC section to be designed at an intermediate impedance, thus improving selectivity due to less loading of both RC sections.

For easier understanding the CA3035 (B11) is shown as three separate amplifiers (ground connections simplified). It is not recommended to place the AF volume control at the input, otherwise the noise of the first stage will be heard. B16 and B19 reduce the gain at higher frequencies, stabilysing the amplifier at low and medium audio frequencies. B18 was needed to avoid saturation of the final amplifier due to RF pickup from the VXO on the same PCB. The high value of B20 is recommended because the three stages of the CA3035 are operated on the same supply line without internal decoupling (danger of motor boating). The hot output line of the CA3035 is shielded to avoid stray coupling to the input which would cause instability. The leads to the volume control potentiometer are also shielded.

A20 is the first capacitor to prevent RF harmonics from leaving the metal case of the transceiver and causing TVI. More capacitors and ferrite beads would have been needed at the keyer and positive supply jacks to solve this problem completely (see Lagos QRPeter). As a substitute shielded cables were used for these connections.

The whole transmitter was built into a Teko 4/B aluminium box (137 x 70 x 40mm), most parts being arranged on a single PCP. For the capacitors A8, A18 and B3 mica compression trimmers maybe used, or those foil trimmers manufactured by Dau (A-8563 Ligist, Austria, up to 500pF!). The CA3055 amplifier circuit however had to be additionally shielded, and in future designs a separate PCB will be employed for it, enclosed in a small metal box.

Using a HC-25/U crystal of 14065KHz substituted by DL7MAM, the VXO had a pulling range of about 15KHz, with 7uH for A2. This flexibility in frequency enabled the author to work the 20 DXCC countries needed within about two weeks. Several QRP stations were also worked in this period including GM3RKO, G8IB, ON6QE, G8PG and GM3OXX.

Final Remarks - The most important experience with this receiver was its immunity to AM broadcast stations. Using a 21 metres end-fed wire tuned to 50 ohms, (LC network in low pass form), it never was necessary to insert any attenuation into the mixer input line. As the oscillator power for such a mixer (5mW or more) is easily available from the transmitter section of a direct conversion transceiver, this solution is highly recommended, especially for European receiving conditions. It should also be possible to improve the popular HW7 with such a mixer, tapping the oscillator frequency from the collector of Q4 via a buffer and an amplifier.

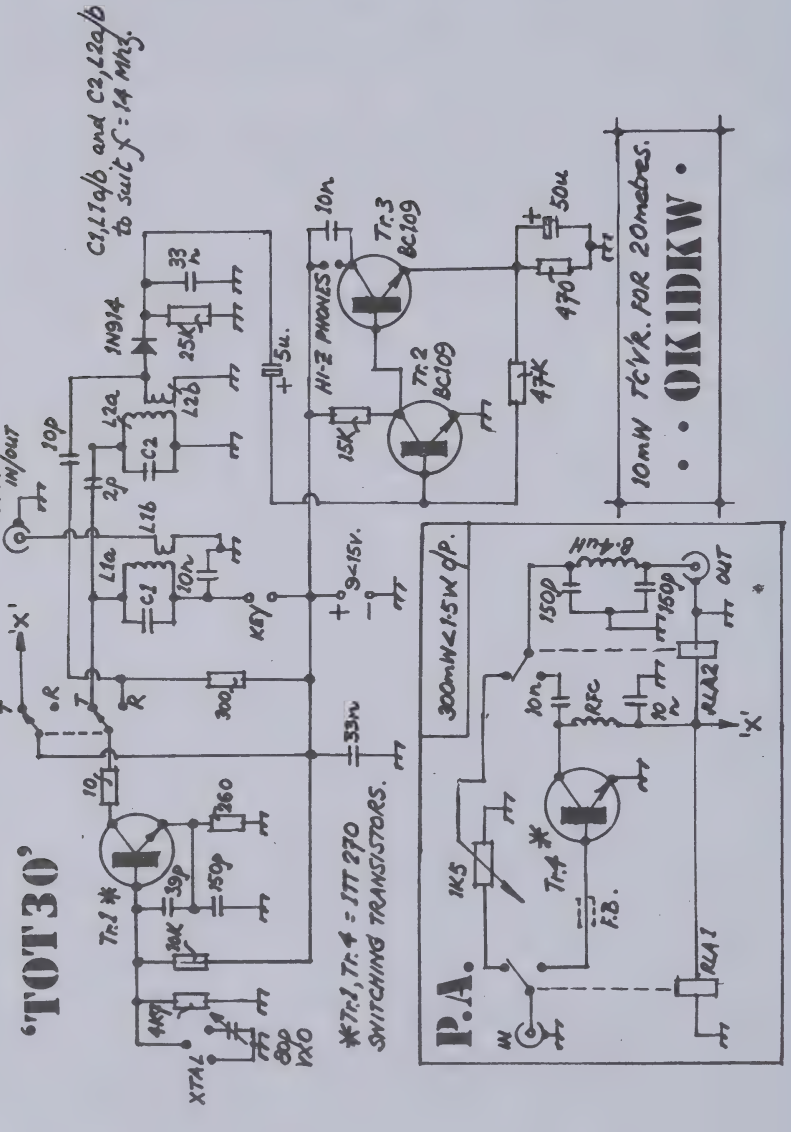
The cut off frequency of the RC network maybe lowered to about 500Hz. Without component limitations more AF selectivity may be added including active filters between the CA3035 amplifiers.

Finally it should be mentioned that the VXO pulling range shows two irregularities where the frequency does a sudden jump. This effect is caused by the emitter resonant circuit, which on the other hand is necessary to obtain optimum power transfer to the PA input. A separate VXO with resistive loading, as in The Lagos QRPeter, will not show this problem, enabling an even larger pulling range.

To make future use of the PCB and the transceiver construction, it will be converted to the new 10MHz band, employing a separate VXO, pi network output and CW monitor. A RIT will also be tried.

RF Coil Data - A2 molded RF choke, 7uH
A10 Amidon T50-6, 15 turns, PA link 4 turns.
A19 Amidon T50-6, 10 turns, output link 5 turns.
B4 Amidon T37-6, 16 turns, mixer link 2 turns.

An RJV Twenty Circuit

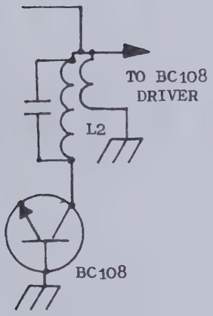


THE TOT 30 TRANSCEIVER By Petr Doudera, OK1DKW

The basic unit, which is placed in an aluminium box is a three transistor transceiver with thirty components with about 10mW output. T1 serves as VXO or CO in transmit mode, it can either operate alone as a QRPpp transceiver for local QSOs or it drives the PA. In receive mode T1 is a local oscillator for the DC receiver. From antenna, the signal goes through a two circuit bandpass filter to a one diode mixer with 1N914 and then to a two stage AF amplifier with two BC 109s. The supply voltage is 9 to 15 volts, and a good compromise for both the transmitter and the receiver is 12 volts.

The PA is in a separate screened box, T4 is with a heat sink, it is connected with the transceiver by a thin coax cable. By simply connecting the points "X" the transceiver will operate with the PA while in receive mode it uses the pi-net and attenuator which is very important for reducing the AM breakthrough.

The receiver is very FB. To my surprise I found it very sensitive considering the number of components. Measured absolute sensitivity was around 2uV. On the band performance was also very good, two-way QRP QSOs with two stations speak in favour of the receiver. I worked I5QHV/2W and G8IB/5W. At my fixed QTH I used my low inverted vee 20 metre end fed antenna and at the /P QTH in Eastern Bohemia, I had a dipole the centre of which was only about 4½ metres high and the ends just 2½ metres high. I have been enjoying both the constructing and operating of this little transceiver. I had a few very interesting QSOs and chats with OH5AD and SM5CBC for more than an hour. I often got words of surprise from the other station, e.g. when I told PA0GVL I was using a 40 component four transistor rig which takes 15 x 15 Cms on the kitchen table running from battery and using that low dipole, he told me "it is unbelievable that you can have a chat with me with such a rig - here is a box full of transistors and ICs."



From "Wee RIG" by GM3OXX in SPRAT 33.

L2 was incorrected shown and has a link winding as shown which goes to the driver stage

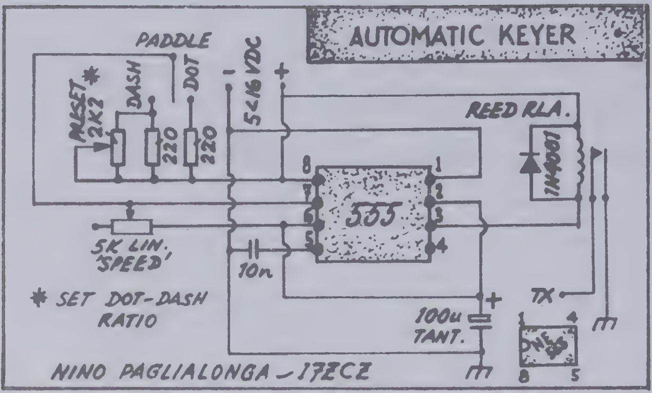
COIL DETAILS:

VFO Coil: 21t. 0.71mm Enal on T-68-6 (tap by adjustment, as low as possible) C1 is about two vanes in an airspaced variable, cut to suit coverage.

L2: 18t. 32swg on 5mm coil + core and can. Link: 4T.

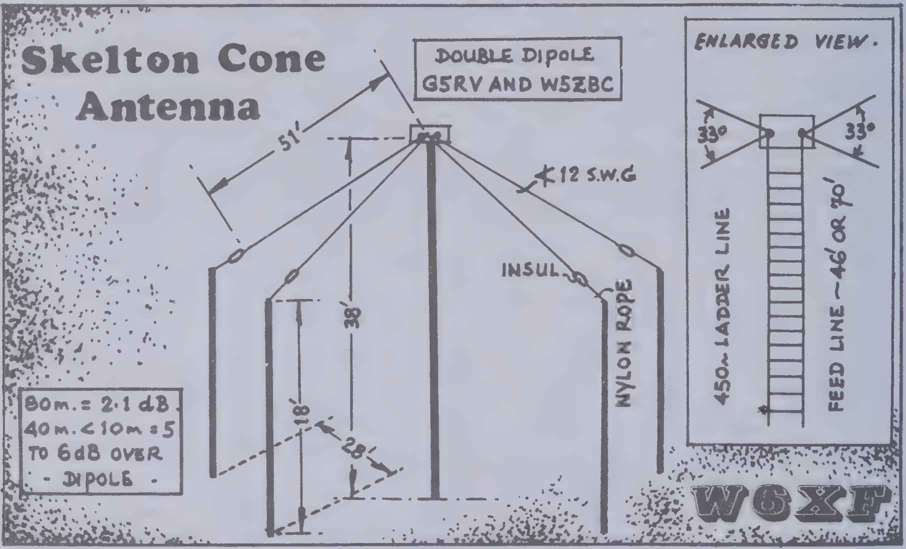
L3: 15t. 32swg " " " "

L4: 12t. 24swg on T-50-6



From:NOTIZIARO QCA QRP CLUB
A KEYER WITH ONE 555 I.C.
Set up on meter on Ohms x10 range.Make dots and adjust speed to flick needle 50%, Makes dashes adjust preset to read 75% FSD.
Power: 5 volts at 15mA
Speed: 20/200 characters per minute.

Note unusual pinout order which follows the Italian circuit drawing.



The basic idea of the Skeleton Cone comes from The R.S.G.B. Handbook (3rd edition), and has claims varying between 2.1 to 7dbs gain over a dipole on all bands. It has a 1:1 SWR over all bands, is used with an antenna tuner and seems to have a pattern of 360 degrees.

Bob Spidell, W6SKQ (355) has been using a Skeleton Cone for some time on the 40 and 80 metres bands. It is suspended from his tower at a height of 38 feet and is fed with 300 ohm twin lead to his homebrew Ultimate Transmatch. The ends of the antenna are 14 feet above earth instead of the designed 18 feet, because of physical limiations at his QTH. Bob has worked JA, UA and KH6 with it and feels it should do well in The U.K.

Bob says that the gain figures are fairly high, but his antenna out performs a 130 feet inverted vee at 38-45 feet above ground, so he is sticking with it. For 160 metres he suggests one could tie the feeders together and operate top load or umbrella fashion.

George, G3RJV describes the antenna as two G5RVs, and it has been his standard antenna for the last two years.

Doug DeMaw[W1FB]on QRP Transmitters and Harmonic Output

In reading the QRP literature for many years it became obvious that some designers of homemade equipment not only ignore the matter of harmonic output from their transmitters, but they apply poor design techniques to the PA tank circuits. The added cost and labour of including a correct tank-circuit design is so minor that it should become a matter of course when developing a new circuit. A correctly designed output network will help to ensure maximum energy transfer to the load (antenna), and will, therefore, increase the overall efficiency of the low power rig.

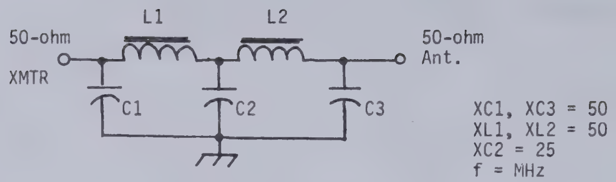
Harmonics - We might wonder how harmonic radiation can be considered a serious matter when we are delaing only with a few watts of power output. But, consider for eaxample, a five watt carrier from a transmitter that has a second harmonic which is only 13dB below the peak output at the fundamental frequency. This is not an uncommon situation with solid state Class C amplifiers, assuming the tank circuit is poorly designed or too simple in format. The power level of the second harmonic would be 0.25 W or 250mW, still QRPp! Suppose also that the fundamental operating frequency was 7010. The second harmonic would appear at 14020, and could be rather ferocious to a nearby 20 meter CW operator. Depending upon the selectivity of the 40 meter antenna, that same unwanted signal could be heard world wide on 20 meters! Having strong harmonics is not only poor operating practice, it is unfair to those who share our bands with us. Furthermore, depending upon the chosen band and operating frequency, we could easily interfere with commercial services and our neighbough's FM and TV sets.

Ensuring that all stages of the transmitter (oscillator excepted) do not self-oscillate under all load conditions will further aid in the reduction of spurious output from the transmitter. Stability is not hard to achieve if ordinary measures are taken.

Typically, the collector circuits of a solid state Class C amplifier has a second and third harmonic current level that is only 10-13dB below the fundamental frequency. This results from conventional envelope distortion (common to tube type amplifiers) plus the varactor action of a transistor junction during the sine wave cycle. For this reason the semi-conductor amplifier generates substantially more harmonic current than is the case with tubes or valves. The output network must therefore be somewhat more elogant than that of a tube style of amplifier.

Matching to the Load - We see some rather bad examples of tank circuit design in the amateur literature. A number of experimenters try to apply vacuum tube network techniques to transistors, and generally that does not work well. The consequenc of such misapplication can be seen as degraded power output,circuit instability and poor harmonic attenuation. Because we are dealing with simple circuits does not mean that the output network of the transmitter must also be simple. Examination of the output spectrum of some homemade transistorised QRP transmitters will often yield a spectrograph that resembles the skyline of NYC at night!!, owing to the myriad unwanted spurious responses! Part of the problem is caused by improper matching and resultant amplifier instability.

How to Resolve these Problems - When in doubt, add a 50ohm harmonic filter.. assuming the PA collector has already been matched correctly to the load (or vice versa if you please). Generally, a half wave filter will provide at least 30dB of harmonic attenuation. The filter QL (loaded Q) is 1, and the reactance of the two inductors and end capacitors is 50 ohms. The reactance of the centre capacitor is 25 ohms. From this information we can develope a filter for the frequency of our choice. For example, let us say we want to build a harmonic filter for use on 40 metres. Since the half wave filter is a low-pass device, the cut off frequency should be somewhat above the operating frequency to prevent unwanted attenuation of the desired RF energy. I usually design the filter for a cut off frequency of 1.13 x the highest operating frequency. Thus, for an upper frequency of 7.1MHz the filter f_{co} would be about 8MHz (8.023MHz). Fig. 1 shows the design progression.



HALF-WAVE FILTER

L1, L2 (μH) = $X_L/2\pi f$ = $50/6.28 \times 8$ = $0.99\ \mu$H

C1, C3 (μF) = $1/X_C 2\pi f$ = $1/(50 \times 6.28 \times 8)$ = $0.000398\ \mu$F or 398 pF

C2 (μF) = $1/X_C 2\pi f$ = $1/(25 \times 6.28 \times 8)$ = $0.000796\ \mu$F or 796 pF

Fig. 1

L1, L2 (μH) = $X_L/2\pi f$ = $50/6.28 \times 8$ = 0.99μH

C1, C3 (μF) = $1/X_c 2\pi f$ = $3/(50 \times 6.28 \times 8)$ = 0.000398μF or 398pF

C2 (μF) = $1/X_c 2\pi f$ = $1/(25 \times 6.28 \times 8)$ = 0.000796μF or 796pF

We will fare satisfactorily by using the next standard value of capacitor at C1, C2 and C3. Hence C1 and C3 can be 390pF and C2 can be 820pF with little impairment of the filter operation. If we wish to be more precise we can use parallel combinations of capacitors to approach the exact computed values. Silver-mica or polystyrene capacitors are recommended for use in the HF range.

For most QRP applications we can use a 0.5 inch OD powdered iron toroids for L1 and L2. The Amidon T50-6 cores are suitable ($\mu i = 8$) which have an A_L factor of 40. The T50-2 cores should be entirely suitable from 1.8 to 14MHz ($\mu i = 10$ and $A_L = 49$).

More elaborate filters can be designed from the normalised filter tables in The A.R.R.L. Radio Amateur's Handbook, transmitting chapter. Data are provided also for impedance matching networks and broadband transformer design. These subjects are treated in considerable detail by Hayward and DeMaw in Solid State Design for The Radio Amateur (A.R.R.L.).

In Summary - I was prompted to write this piece after having found signals on 40 and 20 meters that did not really belong there! They were harmonics of QRP rigs that were supposed to be within the 80 and 40 meter bands! After answering the "phantom"CQs a few times, to no avail, I checked the next band lower, and sure enough...there the culprit was! This condition can be complicated tremendously when a harmonic antenna or trap style of radiator is used, since there is virtually no rejection of harmonic energy by the antenna system.

WARC Converter *Ha-Jo Brandt DJ1ZB*

For those who still own a proven five band receiver or transceiver, this is the easiest approach to listen to the new WARC bands. A single 4MHz crystal oscillator and a dual gate FET are combined to mix 10.1MHz and 18.1MHz to 14.1MHz and 24.9MHz to 28.9MHz. Band switching is accomplished by two independant push button switches. Unused input filters are short circuited. Some of these short circuit bridges are on the PCB, others must be wired by hand on top of the push button switches. The terminating resistor on the 24.9MHz input filter (R11, 8.2K) was also placed there.

In the crystal oscillator a bipolar transistor was used first, but created harmonics which caused spurious reception of broadcast stations from the 16 and 31 metre bands, lying on the slope of the corresponding input filters. The FET oscillator produces a much cleaner waveform and almost eliminates this problem. However, referring to an old RCA recommendation, oscillator voltage at the test point should not exceed 0.5 volts RMS to keep spurious mixer products down.

There are two alternatives to set the operating point of the FET. The first is to omit R3 and to use diode D1 which produces a positive voltage between gate and ground and a corresponding increase in source current after oscillations have started. The other way is to use a gate divider (R3 = 3.3 to 3.9Mohms) to produce a positive voltage at the gate without diode D1. In this case the source current will decrease somewhat after oscillations have started. The reason behind both alternatives is to eliminate a souce choke and to use a relatively high source resistance in order to keep the loading effect on the capacitive divider small. With other FET types it may be necessary to alter the source resistance for best performance.

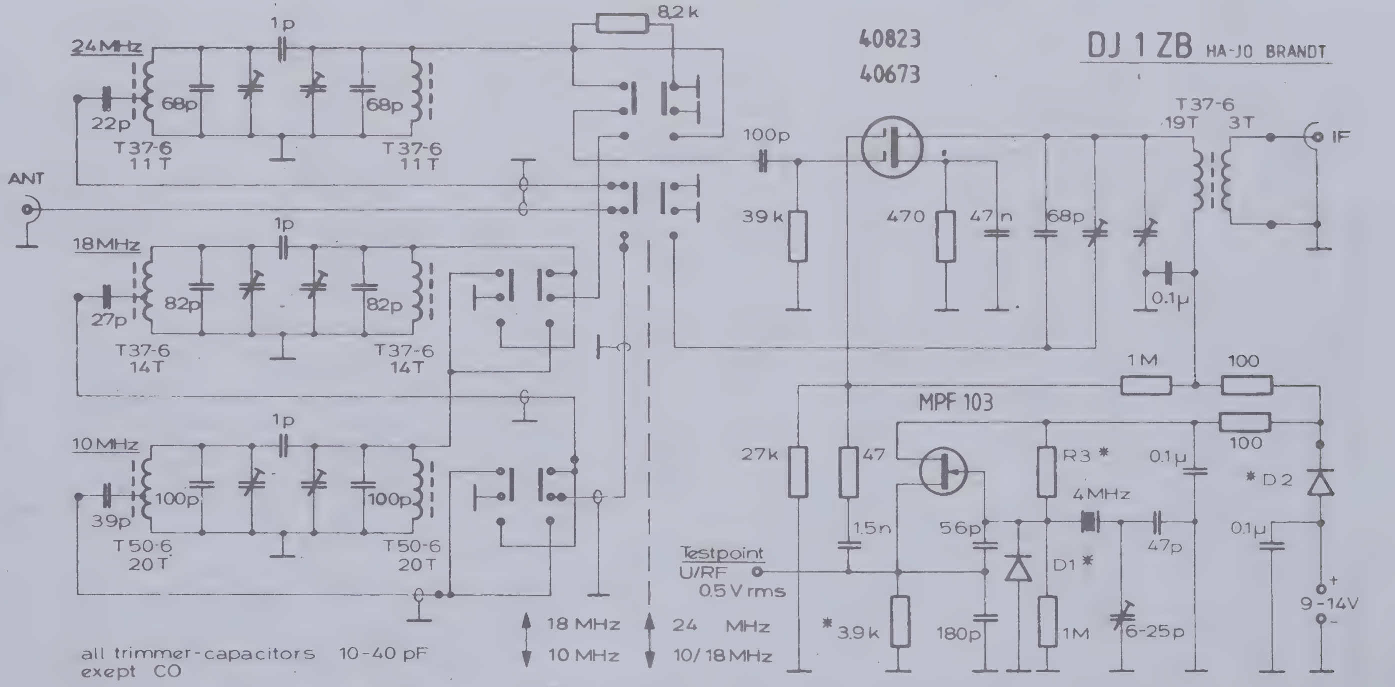
As sensitivity of the converter is more than adequate on 10 and 18MHz and these bands are very close to the 31 and 16 metre bands, performance of the converter may be improved by adding a third (or even a fourth) resonant circuit to the 10 and 18MHz input filters, using the same L and C values. Good input selectivity (which does not consume any DC power) is of prime importance for this "low level" converter which is in extreme contrast to todays mixer philosophy favouring high level mixers with tens to hundreds of milliwatts of oscillator power, but neglecting input selectivity. This converter merely consumes 3mA at 12 volts (9 volts operation is also possible) and will perform well even on long and high antennas.

If anyone finds it desirable to add a bypass switch to the converter, to receive the other bands, care must be exercised not to introduce additional coupling between input and output (increasing IF feedthrough). For the same reason the positive supply jack is directly bypassed for RF, because supply cables may also act as antennas and couple 28MHz or 14MHz signals into the converter box. D2 may be any silicon diode and is recommended to protect the circuit against wrong supply polarity.

To tune the converter, first calibrate the associated receiver at 28MHz. Switch to the 24.9MHz band, tune in the 7th harmonic of the 4MHz crystal oscillator and adjust it to its exact frequency (C7). To align the input and output resonant circuits, an RF signal generator may be helpful, or the spot signal from a WARC band QRP transmitter. The 24.9MHz input (C3 and C6) and the 28.9MHz output (C8) circuits must be adjusted first (maximum S meter reading). Finally switch to the other bands to tune the 14.1MHz output (C9) and the 18.1MHz (C2 and C5) and the 10.1MHz (C1 and C4) input filters.

Converter Measurements

Band (MHz)	10		18		24	
Noise Figure	7.5dB	6 kTo	11dB	12kTo	11dB	12kTo
Gain	19dB		14dB		12.5dB	
Image Rejection	18.1/14.1	64dB	10.1/14.1	71dB	32.9/28.9	52dB
IF Feedthough Rejection	14.1	52dB	14.1	64dB	28.9	39dB

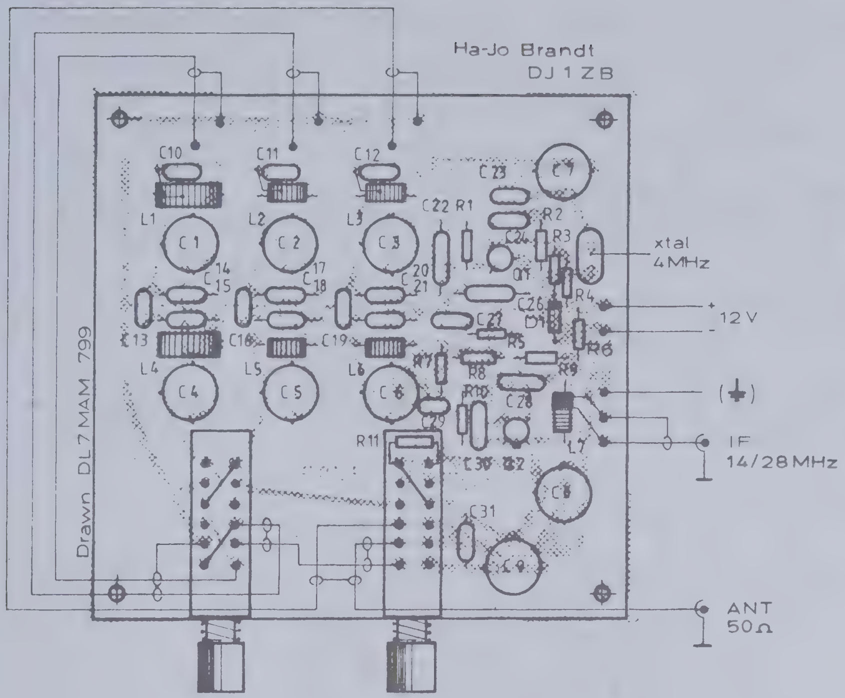


all trimmer-capacitors 10-40 pF
exept CO

HA-JO's WARC CONVERTER

Input	Output
24.9 MHz	28.9 MHz
18.1	14.1
10.1	14.1

* see text



Placement-Guide for WARC-Converter   PCBs available

Placement Guide, parts identification

C1 to C6	ceraminc trimmers, 10mm ø, 10-40pF		
C7	" " 6-25pF		
C8, C9	" " 10-40pF		
C10	ceramic 39pF		
C11	" 27pF		
C12	" 22pF		
C13, C16, C19	" 1pF		
C14, C15	ceramic, mica, styroflex or polystyrene, 100pF		
C17, C18	" " " " 82pF		
C20, C21	" " " " 68pF		
C22	" " " " 180pF		
C23	ceramic, 47pF		
C24	" 0.1uF	C29	Ceramic, 100pF
C26	" 56pF	C30	" 47nF
C27	" 1.5nF	C31	" 68pF

R1	3.9K	R4	100 ohm	R7	39K	R10	470 ohm
R2	1M	R5	47 ohm	R8	27K	R11	8.2K
R3	See text	R6	100 ohm	R9	1M		

L1, L4	10MHz coils (T50-6))
L2, L5	18MHz coils (T37-6))
L3, L6	24MHz coils (T37-6))
L7	Output coil (T37-6)
D1	BAW75, 1N914, 1N4148

taps of the input coils are at one half of the total turns

80 to 2metres Receive Converter

John Reynolds G3PTO

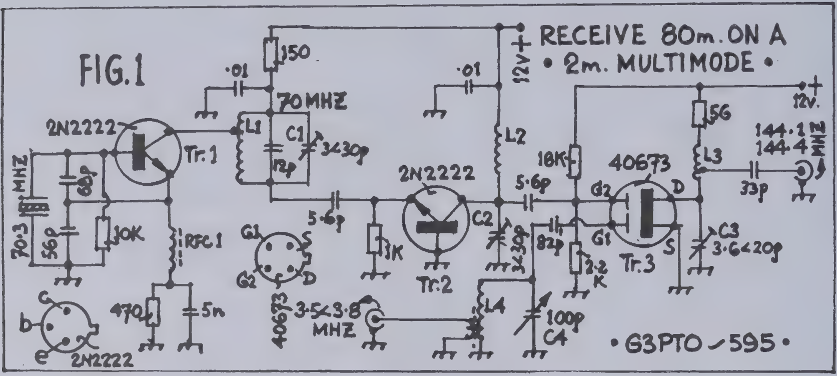


FIG.1

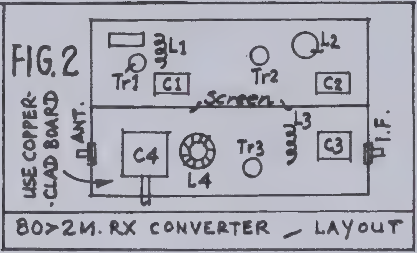


FIG.2

80>2M. RX CONVERTER – LAYOUT

It is hoped that this converter will be of interest to many aspiring Class A amateurs and also to those Class A licencee's who are short of cash and wondering what commercial HF transceiver to buy, ugh!

I constructed my prototype using copper clad board and usual VHF type construction, i.e. the board acts as a ground plane and the componenets form a rats nest above. All of the components were from old computer boards or TV spares, with the exception of the crystal, which came from a rally stand. The only problem which is likely to occur during testing is in the oscillator and doubler stages. I used a G3RJV RF probe and multimeter on the lowest current range. Possible improvements may be in the front end, but first results seem to indicate no problem.

My VHF transceiver is an Icom IC260E and 144.1MHz corresponds to 3.5MHz, 144.4MHz to 3.8MHz. It is eventually hoped to construct a transmit converter but in the meantime a simple QRP solid state transmitter is used.

The LAIM Transceiver *Ha Jo Brandt DJ1ZB*

This a 10MHz VXO-DR-PA, two watts output, with direct conversion receiver. After designing the "Twinnyset" for the G3RJV Twenty Trophy, the author would not keep it merely as a curiosity. He wanted to convert it to a 10MHz rig to increase QRP activity on this new band, and to add some features which could not have been realised with the 40 components: larger VXO range, RIT, aerial tuner with relative power indication, and CW monitor. This work resulted in The Laim Transceiver, which now is operated by DK5RY, first from HB0 during the Activity Week-end of 11/12 September 1982. Laim, to be produced like Harry Lime in the well known Orson Wells motion picture, is the quarter of Munich in which DL7MAM and DJ1ZB are living.

Receiver Section - No changes were made on the basic receiver circuit (SBL-1 diode ring mixer and CA3035 AF amplifier), because sensitivity and freedom from AM feed through were sufficient even for working other QRP stations. Just the output capacitor of the RC audio low pass filter was increased to a 0.47µF to improve CW selectivity.

As mentioned in The Twinnyset article, the main problem of this receiver was to shield the high gain AF against the RF generated in the VXO on the same PCB. One metal shield had to be added around the CA3035 (see photograph), another below the PCB. Because of these reasons the details of the original PCB are not given here. For future designs it is recommended to use a separate PCB for the AF amplifier (preferably begining with the second section of the RC low-pass filter), enclosed in an extra metal box. This PCB may include the 4093 CW monitor.

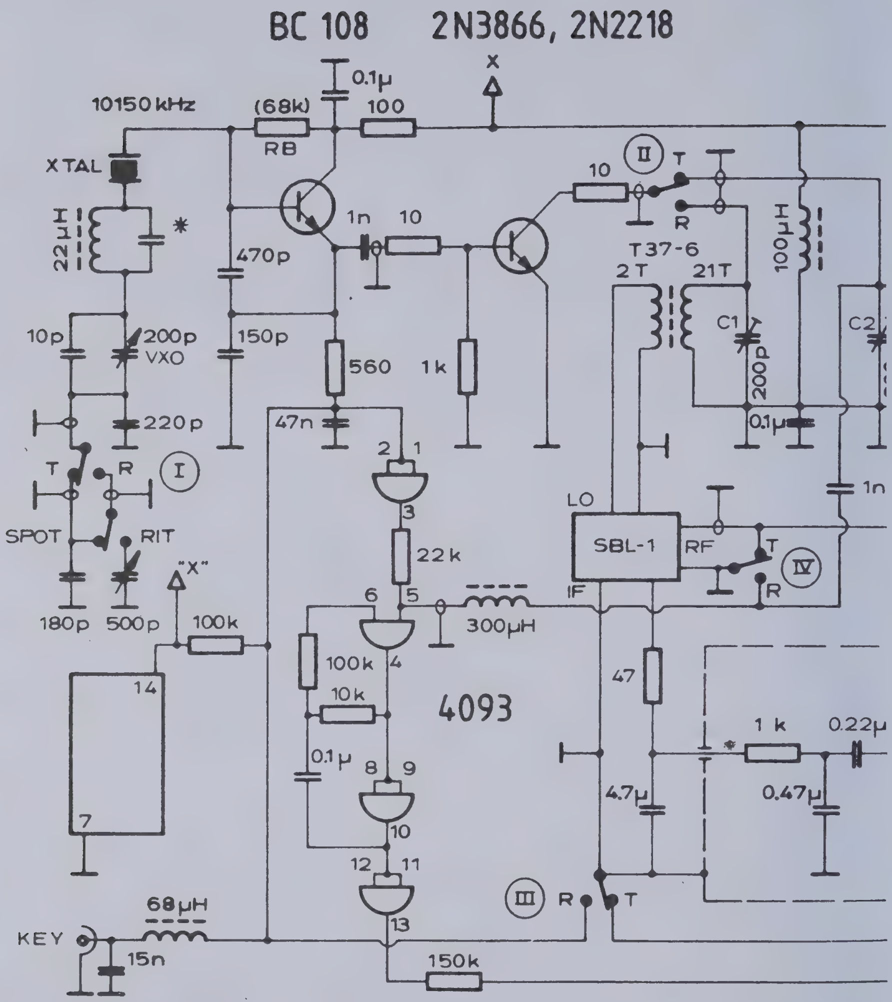
Fighting Receiver Hum - On this occasion, some remarks on the hum problem in DC receivers will be necessary. When the receiver oscillator is not operating, hum in the receiver is caused by either a poorly regulated supply or by AC currents or fields coupled directly into the AF amplifier. These problems should be cured first. It should be possible to turn the volume control to maximum sensitivity without any sign of amplifier instability. When oscillator and mixer are operating, hum is caused by oscillator radiation. The radiated oscillator power will be received by the electrical installation of the house and will be AC modulated in the rectifier diodes of other electronic equipment. This modulated RF is radiated back to the receiver and causes an annoying hum, which makes weak signal reception impossible (and a high gain AF amplifier in the receiver impracticable).

There are three ways to cure this hum problem:-

1. Operate the receiver in the field only, far from AC power lines, on a batter supply.
2. Bypass all rectifier diodes in your house with 4.7nF ceramic disc capacitors of sufficient voltage rating (can you reach them all?).
3. Reduce oscillator radiation as far as possible!

To realise No. 3, especially when employing a diode ring mixer with a high oscillator power, a DC receiver should be housed in a metal case. When experimenting on such a receiver, with the case open, in most cases some hum will be present. Oscillator leakage via the aerial input is sufficiently low, due to the symmetrical design of the diode ring mixer. But other leads leaving the metal case such as supply voltage, headphone cord and the cable to the key, may radiate much better! In the case of the Laim transceiver, an LC filter was necessary directly at the key jack, and a 0.1µF ceramic disc capacitor had to be placed from the positive headphone terminal to ground. Wiring all internal AF and DC leads with sheilded cable will reduce oscillator radiation and residual hum during receive even further.

Transmitter Section -After some rewiring on the original Twinnyset PCB, the oscillator transistor was replaced by the driver transistor, a PNP type (2N5160) in this case, because both collector resonant circuits were at ground potential. In new designs, however, a popular NPN transistor should be employed. The DAU foil trimmers used for C1 and C2 are now available from Ambit (up to 500pF). VXO and PA are similar to those shown in the author's 10MHz transmitter (SPRAT, Summer 1982). The VXO is covering the whole band, with the exception of the



✱ see text
FB ferrite bead

10 MHz -Trar

STOP PRESS NEWS – G-QRP CLUB

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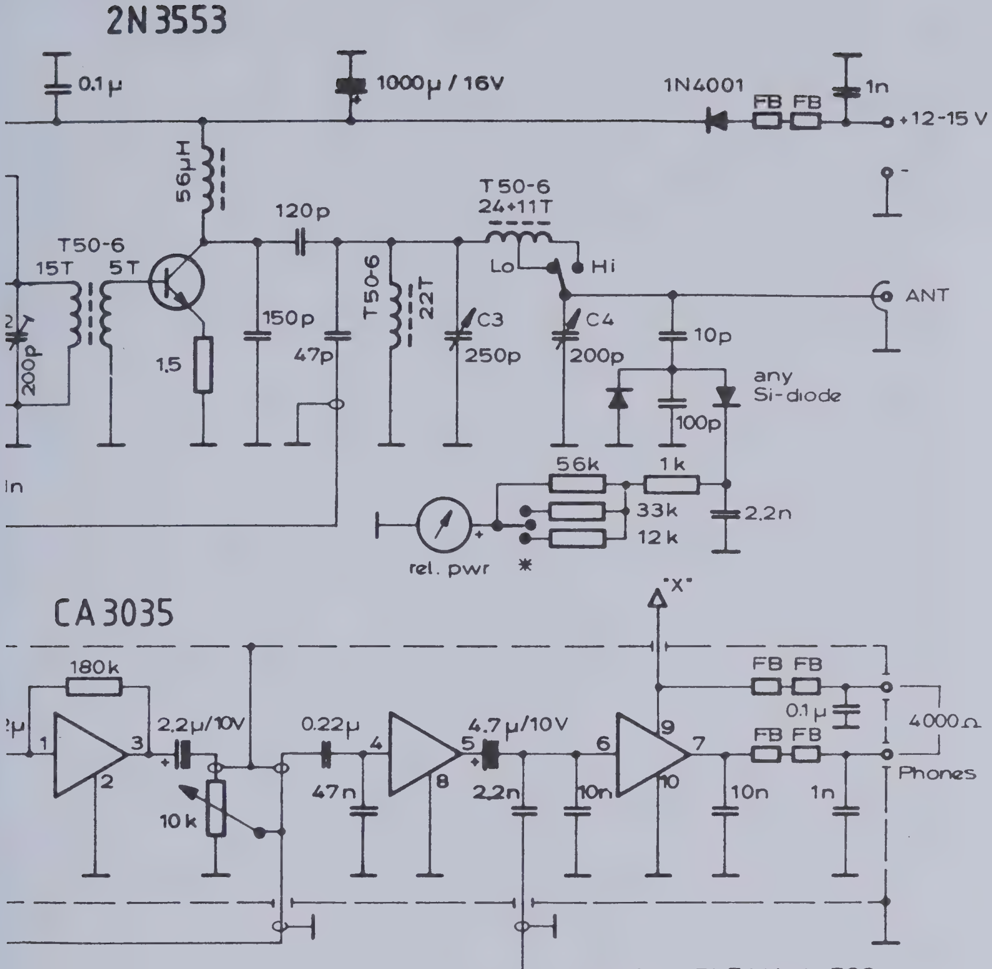


drawing: DL7MAM 799

nsceiver

LAiM

last 5KHz, which had to be sacrificed for the RIT. The PA tank can be switched to match coax fed aerials (LO) and high impedance longwires (HI). The relative power indication has three fixed sensitivity steps using a miniature toggle switch with a zero position. By sensing the DC potential at the key jack, the CW monitoring tone is generated in a 4093 CMOS oscillator and fed into the AF amplifier of the receiver.

VXO and RIT - This is the first VXO on which the author has tried a RIT. Because the RF voltages on the crystal are rather high, capacitance diodes cannot be used for this purpose. Therefore a variable capacitor and switches operating in the RF circuit are necessary. But as the RIT circuit is shunted by the 220pF capacitor, the switches and the RIT capacitor may be mounted at convenient locations on the front panel. Connections are made by coaxial cables, the capacity of which merely adds to the 220pF capacitor. The SPOT capacitor of 180pF, representing the centre position of the RIT is about one third of the maximum RIT capacity due to the non linear relationship between capacity and VXO frequency Also, the frequency pull of the RIT is dependant on the setting of the VXO capacitor, being just sufficient at the upper band edge (10145KHz) but more than necessary at the lower end (10100KHz).

Transmit - Receive - Switch - A four section miniature toggle switch has been used to change from transmit to receive. Section 1 allows the RIT to be active in the receive position only. Section 2 connects the driver output to the PA in transmit and to the mixer in receive. Section 3 is to shortcircuit the receiver AF during transmit (to produce a clean CW monitor tone) and operates the VXO continously in the receive position. Finally, Section 4 closes the mixer input in the transmit mode and has two functions during receive. It directly detunes the PA input circuit (to bypass aerial energy which may leak into the oscillator path of the mixer), and via the 330µH choke it prevents the CMOS circuit from generating a continuous tone.

Tuning the Laim - First, the VXO pulling range is optimised by trimming the small capacitor across the 22µH coil (consisting of two twisted insulated wires maximum 1-2pF). Then the transmitter is tuned for maximum power output (C2, C3 and C4) to a dummy load and the VXO bias resistor RB varied for almost equal power output (ca 2 watts) within the tuning range of the VXO.

For tuning the mixer input resonant circuit (C1) the transmitter is operated near the lower band edge (10100KHz) and the frequency checked in a separate receiver (zero beat). Then the Laim is switched to receive, in the SPOT mode, and the oscillator signal will be heard in the receiver with a differing beat note, due to different loading of the driver output. By tuning C1 the beat note can be readjusted to zero beat. Switching to transmit again will show that there is no difference between transmit and receive frequency. In practical operation a received station is spotted by tuning the VXO to zero beat. After this, the RIT is used to produce a beat note again on either side of zero beat, depending on the QRM situation.

Thank You

May I thank everybody from the club who greeted me with cards and gifts on my 40th birthday in July. Thanks for some secretive work by G3VTT and G4BUE half the world seemed to know that I had reached middle-age.

Many thanks to those who attended the celebrations during my trip to the south of England, especially Rich, G5CSU, for coming from Norfolk and Brian, G3SYC, for coming from Pontefract. Especial thanks to the lovely Brenda and Pam, Colin and Chris, ROO and Dave. QRPers are a great people, I will remeber it for years! By the way, I'm forty-one on the same day next year.......G3RJV

Simple 14MHz Receiver

Ian Braithwaite G4COL

My first contribution to SPRAT is a simple receiver which, although designed firstly for 14MHz, can easily be adapted for other bands merely by altering the tuning components L1 and C1/C2. The receiver consumes more than 20 components, but these are put to good use, since the receiver has a RF amplifier - cum - preselector and an audio CW filter. It is also designed for use with 8 ohm headphones, which many people use these days.

The first experiments showed that 1mV across the author's cheap 8 ohm headphones gave a readable signal. A sensitivity such that 1uVolt signals could be copied comfortably was set as the minimum target. The mixer has a loss of about 7dB, so that a gain of around 2200 (voltage gain factor) is required to get back to 1mV at the output. Some 88mH toroids, which were brought a good few years ago, were then tested, and found to have a DC resistance of 8 ohms or so. The reactance of an 88mH inductor is about 550 ohms at 1KHz. If a Q of 50 can be attained at this frequency, a 1KHz tuned circuit would have a dynamic resistance of 50 x 550 = 27.6K, since dynamic resistance = Q X Reactance for large Q's. If a 1KHz tuned circuit is placed round an operational amplifier as shown in the circuit with a 10 ohm resistor to ground (C9 has a reactance of only 1.6 ohms at 1KHz), a gain of approximately 2400 will result. This all worked out in practice. The Q turns out to be around 50, giving a bandwidth of 20KHz between the 3dB points. The audio amplifier has unity DC gain for good DC stability and only low gain at 50/60Hz so that mains hum, which can plague direct conversion receivers, is rejected.

The input RF amplifier provides more useful gain and selectivity. TR1 is a common gate amplifier with a 14MHz tuned circuit in the drain. TR2 is a source follower, providing a transformation without loss between the high impedance of the tuned circuit and the low impedance of the mixer. Note that R5, decoupled by C7, provides a good termination to the mixer for the RF mixing products. Note that in the preselector, there is no need to do any coil winding since a 2u2 RF choke (as sold by Maplin) has a reasonable Q at 14MHz. The output of the selective audio stage (see above) feeds emitter follower TR3 via the volume control, providing drive for headphones of 8 ohm or higher impedance.

Unfortunately, 88mH ready wound toroids are not as readily available as they were. A pot core type should be at least as good. Resistance should be added in series with the inductor if the Q is too high, since this will make CW hard to tune and copy

The local oscillator used was a VXO around 14060MHz, about which more later. Any oscillator will do provided that it can provide sufficient drive to the mixer (nominally a 50 ohm load). A drive level of 7dB (500mV) is ideal, but cam be some what less before the effect becomes serious.

The receiver was first tested by listening to the band, and gave very good results. Lab tests showed that 0.3uVolt signal could be copied quite comfortably.

Parts List

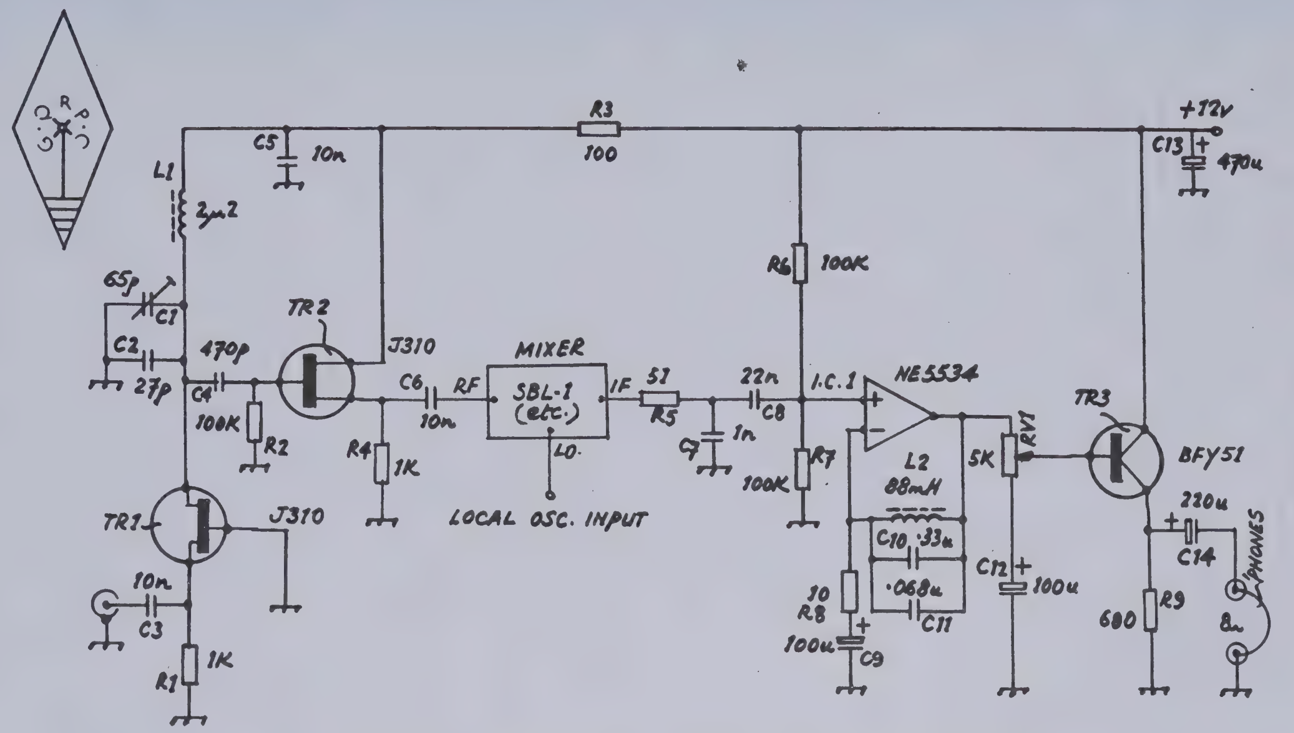
R1 1K, R2 100K, R3 100, R4 1K, R5 51, R6 100K, R7 100K, R8 10, R9 680, RV1 5K log,

C1 65pF trimmer, C2 27pF ceramic plate or polystyrene, C3 10n ceramic disc, C5 10n disc, C6 10n disc, C7 1n disc, C8 22n disc, C9 100u 16V electrolytic, C10 0.33u mixed dielectric (non-polarised), C11 0.068u mixed dielectric, C12 100u 16V electrolytic, C13 470u 16V electrolytic, C14 220u 16V electrolytic.

TR1, TR2 J310 FET, IC1 Signetics NE5534, Mixer Mini Circuits SBL-1, TFM-2, Anzac MD108. L1 2u2 RF choke (see text), L2 88mH toroid or pot core (see text).

JOHN McGREGOR, GM3KNX. We regret to announce the death of GM3KNX, club member 132. John was in his 90's and thought to be the oldest active amateur in GM. He was active on CW a week before his death and is remembered for his cheerful willingness to help other younger radio amateurs. A sad lost to the hobby.

CORRECTION: SPRAT 35 - 10MHz Transverter. The "B" arrow signal goes to the input of the bottom circuit stage. The 2N3819 Xtal oscillator is shown with the 0.1uF decoupling cap on the wrong side of the coil L4. The text at the end of the Coil Details section is misplaced from another article and should be ignored.



• SIMPLE 14MHZ RECEIVER • • • G4COL •

50ohm Low Pass Filters for Transmitters

Ed Wetherhold W3NQN

In The Summer 1983 issue of SPRAT, Doug DeMaw, W1FB discussed a problem many QRP operators are completely unaware of - the presence of excessive harmonic levels at the output of their QRP transmitters. Doug mentioned that the typical solid state Class C amplifier has second and third harmonic current levels that are only 10-13dB below the fundamental frequency! A 50 ohm five element harmonic filter was recommended for connection at the transmitter output to provide at least 30 dB of harmonic attenuation, and equations were given to solve for the component values. For more elaborate filters, the reader was referred to the normalised filter tables in The A.R.R.L. Radio Amateur's Handbook.

Those who wish to have an additional 12 dB of harmonic attenuation over that of the five element filter, and who wish to omit the calculations will find the data in Table 1 to be of interest. Here are fifteen designs of 50 ohm seven element Chebyshev low pass filters suitable for use by The U.K. amateur. This table was comprised from three recently published articles which listed all filters that could be constructed with standard value capacitors. From these published tables, fifteen designs were selected that best meet the requirements of The U.K. amateur.

Most of the column headings in Table 1 are self explanatory. The F-co column heading lists the ripple cutoff frequencies, while the F-3 and F-40 dB frequencies are those frequencies at the 3 and 40 dB attenuation levels. The R.C. column lists the reflection coefficients of each filter. Up to the cut off frequency (F-co), the reflection coefficient listed under R.C. will never be exceeded. The capacitor and inductor component values follow after the R.C. values. The publication reference source and the design number used in the reference are given in the last three columns. These references are internationally distributed and should be available in The U.K. if one wishes to confirm the listed designs.

Several designs are listedfor each amateur band with the intent that the reader use the design which is most convenient to assemble. Only the commonly available 10% series of capacitors are required (except for C3, 5 in design 6), and all designs have less than 1.15 VSWR (corresponding to a reflection coefficient about 7%). For best results, use silver mica or polystyrene capacitors having a 5% tolerance. Between 30 and 40 dB of harmonic attenuation is available one octave above the cutoff frequency as can be seen by the entires under the F-40 dB column heading.

Although the seven element filter requires two additional components compared to the five element filter, the advantages of greater harmonic attenuation, more convenient capacitor values and the absence of calculations greatly outweigh the disadvantages.

The seven element network configuration is that of a ladder with alternating shunt capacitors and series inductors. From left to right, the network branches are labelled 1 to 7 with all odd branches containing a shunt capacitor and all even branches containing a series inductor. Because the numbers refer to the branches, there are no even numbered capacitors and no odd numbered inductors; consequently, the reader should not be confused by the non-sequential numbering of the capacitors or of the inductors. That is, there is no C2 and C4, or no L1, L3 and L5. This numbering derives from the commonly accepted network numbering procedure where the branches are numbered sequentially. The capacitor or inductor in a particular branch then assumes the number of that branch.

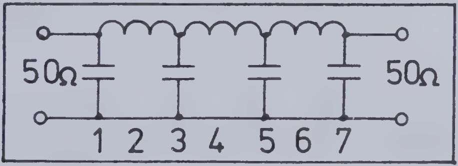
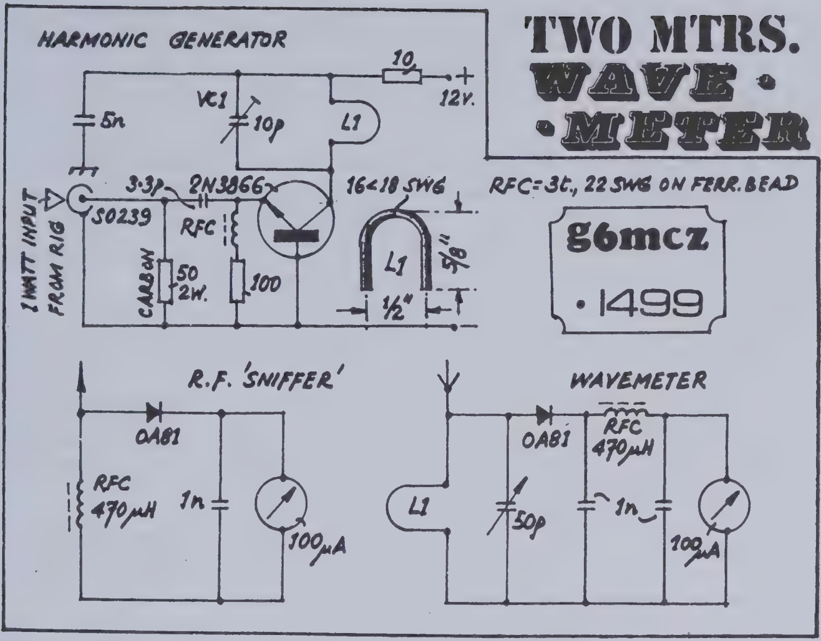


Table 1. 50-ohm Lowpass Filters Using Standard-Value Capacitors (for Amateur Radio Transmitters)

No.	Bands[1]	F-co	F-3dB	F-40dB	R.C.	C1,7	C3,5	L2,6	L4	Publication & Design No.		
	(MHz)	(MHz)			(%)	(pF)		(μH)		EDN[2]	ELECTRONICS[3]	QST[4]
1	1.825-1.830	2.022	2.34	3.7	4.11	1200	2700	5.41	6.40	162	44	160M
2		2.155	2.76	4.6	1.175	820	2200	4.44	5.61	55	53	---
3	3.5 - 3.6	3.694	4.24	6.66	4.64	680	1500	2.99	3.52	192	74	---
4	3.6 - 3.8	4.125	5.11	8.38	1.74	470	1200	2.43	3.01	85	83	---
5		4.719	5.35	8.34	5.50	560	1200	2.37	2.76	202	84	---
6	7.0 - 7.04 7.04- 7.10	7.225	8.40	13.3	3.86	330	750	1.51	1.79	226	108	---
7		7.362	9.04	14.8	1.93	270	680	1.38	1.70	115	113	---
8		8.583	9.60	14.8	6.875	330	680	1.32	1.52	232	114	---
9	14.0-14.1 14.1-14.35	14.40	16.4	25.6	5.16	180	390	0.773	0.904	142	24	---
10		17.46	22.5	37.5	1.11	100	270	0.545	0.689	45	43	---
11	21.0 -21.15 21.15-21.45	21.55	27.6	46.0	1.175	82	220	0.444	0.561	55	53	---
12		25.24	28.9	45.4	4.712	100	220	0.438	0.515	172	54	15M
13	28.0 - 28.2 28.2 - 29.7	30.90	35.4	55.5	4.775	82	180	0.359	0.421	182	64	---
14		31.65	40.5	67.5	1.19	56	150	0.303	0.382	75	73	---
15		36.94	42.4	66.6	4.64	68	150	0.299	0.352	192	74	10M

NOTES:

1. Frequency bands taken from Table 19.7 (Region 1 HF Band Plan), p. 19.5, *Radio Communication Handbook*, 5th Edition, RSGB, 1982.
2. *EDN*, Vol. 26, No. 1, pp. 187-190, 7 January 1981.
3. *Electronics*, Engineers' Notebook, pp. 160-161, 19 June 1980.
4. *QST*, p. 45, December 1979.



2 METRE WAVE-METER CALIBRATION By Geoff Gardner, G6MCZ

Most newcomers to Amateur radio will, like myself, make straight for the two metre band. To comply with our licence we require a wave-meter that covers 144 - 288MHz or more, 288MHz being the second harmonic. Commercial wave-meters cost about £15 - £20, whereas a home-made one only costs about £3! The difficult part about making a wave-meter is the calibration of the second harmonic point on the dial.

Here is a circuit that can be connected to the output of a 2 metre 'black box', to generate the second harmonic.

R1 is a dummy load and can be 47 or 51 ohms carbon resistor at two watts. RFC is three turns of 22 SWG on a ferrite bead and TR is a 2N3866.

Set-up and Use:-

1. Connect a 12 volt suppy.
2. Connect your rig to the SO 239 and do not put more than 1.5 watts into this circuit.
3. Place a RF sniffer near L1 abd key the microphone, adjust VC1 for maximum reading on the RF sniffer.
4. As you can see the RF sniffer can become a wave-meter and use the same components. Do not go to a lot of expense over the above circuits, or you will defeat the object!

Calibration :-

After the harmonic generator and wave-meter have been constructed, calibration can begin. First, check that the wave-meter responds to a 144MHz carrier. If the vanes of the 50pF capacitor are almost fully meshed at this point, all is well, and you should be able to find the second harmonic with the tuning capacitor near minimum (un-meshed).

Horizontal X Beams Brice Anderson W9PNE

An X Beam is basically a two element yagi with shortened elements pulled together at the centre. Wire loading tails at the ends of the arms compensate for the shortened arms.

The final form of the X beam is as shown in the sketch. All arms are of the same length, but the driven element tails are longer than the director tails.

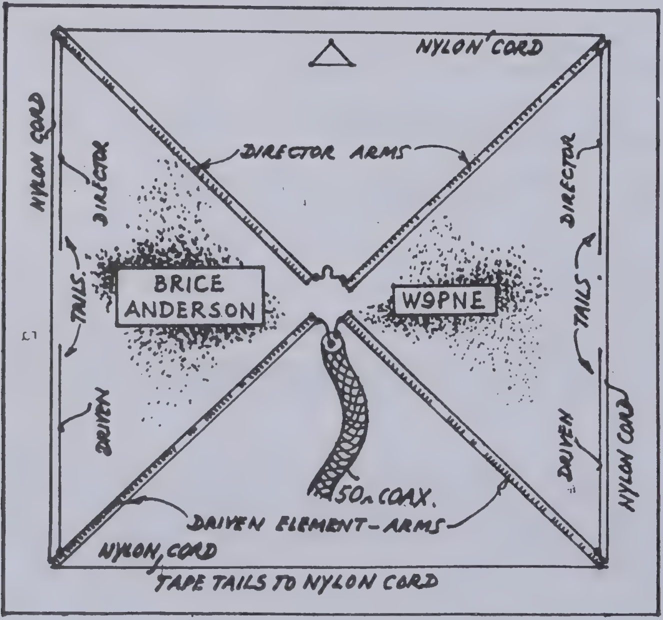
I have determined that the arms may be as short as 75% of the length of one half the driven element of a conventional yagi, using tubing. If the arms are much shorter, the tails will touch. The longer the arms, the shorter the wire tails will be. I use (U.S.A.) No. 19 stranded vinyl covered wire for the tails. Wire size is not critical, and smaller wire will require longer tails.

The total length of the director element is about 4.7% less than the total length of the driven element. With the tail length difference shown in the chart, the gain is 5 to 6 dB, the front to back ratio about 15dB, and the SWR between 1:1 and 1.5:1. The antenna is very broad banded.

For the 15 and 20 metre X beams I mounted the arms on a 15 inch square piece of ⅝ inch thick plywood with pipe brackets. I used pieces of plastic hose to insulate the driven element arms at the hub. Pieces of 2 x 2 inches wood on the underside provided a mount for a 2 x 2 inches wooden stub mast. I used several coats of shellac to weatherproof the wood, and followed up with two coats of aluminium paint after completing the antenna.

For the 10 metre X beam, I bolted two 12 inch long pieces of ¾ x ¾ x ⅛ inches aluminium angle stock together to form the X hub. I fastened the arms (¾ inch diameter aluminium clothes line props) to the hub with worm gear type hose clamps, insulating the driven element arms with plastic hose.

Build the beam with longer tails than specified, but with the proper length difference. Mount the beam on a 10 feet pole for tuning. The resonant frequency of the antenna can be determined with a dipper coupled to the director (with a

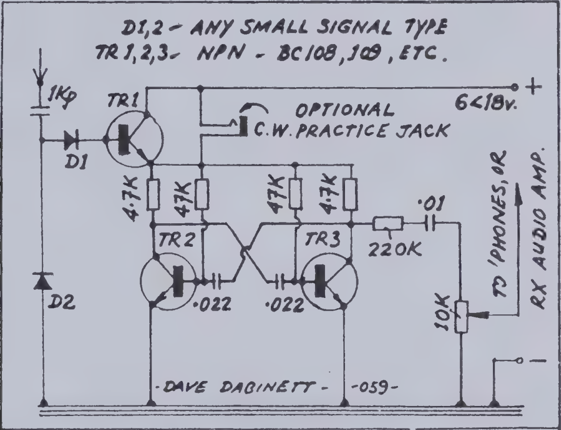


50 ohm dummy load on the driven element), or with a SWR bridge a few feet below the driven element.

If the resonant frequency is too low, trim one inch from all four tails (½ inch on 10 metres) and recheck resonance. Continue until the antenna is at the desired frequency. The resonant frequency will increase some when the antenna is raised to mast height.

X Beam Dimensional Chart

	Band	Arms	Driven Ele. tails	Director tails	Tail length Diff.
As tested	10 m.	6ft. 6in. (3/4 in. OD)	4 ft. 1 in.	3 ft. 7 in.	6 inches
As used	15 m.	9ft. 3in. (1",7/8",3/4")	4 ft. 10 in.	4 ft. 2 in.	8 "
Calculated Min. arm length	15 m.	8ft. 5in. (1",7/8")	6 ft.	5 ft. 4 in.	8 "
As used	20 m.	13ft. 9in. (1",7/8",3/4",5/8")	7 ft. 8 in.	6 ft. 8 in.	12 "
Calculated Min. arm length.	20 m.	12ft. 5in. (1",7/8",3/4"/5/8")	9 ft.	8 ft.	12 "
Calculated Min. arm length	30 m.	17ft. 4in. (11/8",1",7/8",3/4",5/8")	12 ft. 6 in.	11 ft. 1½ in.	16½ "
Calculated Min. arm length	40 m.	24ft. 10½in.	18 ft.	16 ft.	24 "


D1,2 - ANY SMALL SIGNAL TYPE
TR1,2,3 - NPN - BC108,109, ETC.
1Kp
TR1
D1
OPTIONAL C.W. PRACTICE JACK
6<18v.
+
4·7K
47K
47K
4·7K
TR2
TR3
·022
·022
·01
220K
D2
10K
TO 'PHONES, OR RX AUDIO AMP.
−
-DAVE DABINETT-
-059-

R.F.-FIRED C.W. MONITOR — G4DEP

This device picks up a sniff of RF which turns TR1 on in sympathy with your keying!! Use a throw out antenna or a few turns around the transmitter antenna.

The transistors are any NPN type, BC108/109 worked OK. The diodes are any small signal type. The monitor was found to work OK with QRP rigs, and several have been built by local club members of The Yeovil Amateur Radio Club. The LM380 Audio IC was found to make a good audio amplifier for it.

A Premix VFO for 10·1MHz & 14MHz

Matt Volkert DK4SQ

As it is rather difficult to build a stable VFO for higher frequencies, this circuit uses a low frequency VFO, which is heterodyned with a crystal oscillator.

The actual VFO covers 3.85 - 4.0MHz, which should be low enough for stable operation. The crystal frequencies are 14MHz and 18MHz. The mixer therefore generates 10.0 - 10.15MHz and 14.0 - 14.15MHz.

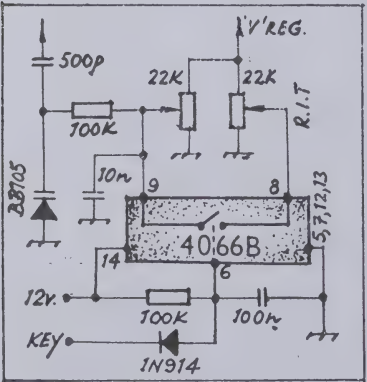
These oscillator frequencies are chosen for two reasons: First you can listen to all frequencies with your main receiver (if it includes the new bands). This is very helpful when you want to check the operation of each stage. Second 14.0MHz and 18.0MHz crystals are ready made available and quite cheap, although I must admit that the 14.0MHz crystal is not very common.

You may, of course, choose other frequency combinations than these if you have other crystals in your junk boxe or if you wish other output frequencies. It is recommended, however, that the crystal frequencies are above the desired output frequencies, as then the mixer image and the crystal frequency itself will be attenuated by your transmitter low-pass filter.

The actual VFO is a Hartley oscillator. The tuning capacitor, C1, is out of an old FM receiver, the two 12pF sections in parallel, C2 is used to set the band edge. All fixed capacitors marked with an asterisk should have a low temperature coefficient (NPO ceramic or styroflex). The varicap diode provides about 3KHz RIT. With the 22K preset you can set the transmit frequency. This should be preferably in the centre of the RIT range so you can listen on both sides of zero beat with your DC receiver.

The VFO signal is fed via the 12pF capacitor to the SO42P mixer. This balanced mixer needs only very few external components and is used in self oscillating mode. The crystals and the tuned circuit at the mixer output are diode switched. The switch itself may therefore be at any convenient place on the front panel. Notice that the switching is done by the regulated voltage regulator, otherwise there would be a noticeable frequency change when varying the voltage supply.

Following the mixer is a buffer amplifier which provides an output of about 1.2 volts across 50 ohms. When adjusting the tuned circuit at the mixer output, start with 14MHz (C3), and then tune the 10MHz trimmer, C4. Make sure that you do not tune to the image or other unwanted frequencies. If properly adjusted they are at least 35dB below the wanted signal.



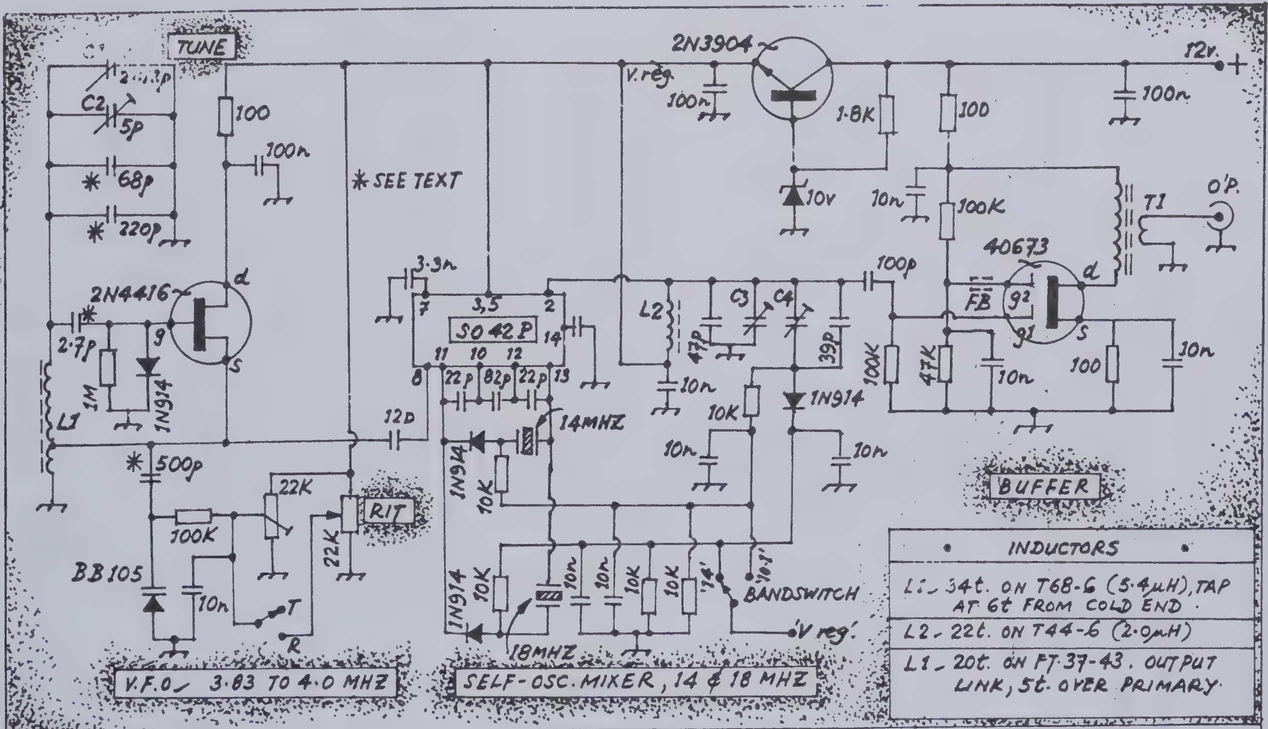
• ELECTRONIC •
• RIT – SWITCHING

NOTES:

1) Electronic RIT switching (break-in) may be used as per the insert circuit using the CMOS analog switch - 4066.

2) Some switching diodes may have a current so low that they are not adequately conducting which may give low output on 10.1MHz, if so change the diodes or use smaller resistors.

3) If less output power is required, the gain of the buffer can be adjusted by making the 47K resistor variable.



• INDUCTORS •

L1 – 34t. ON T68-6 (5·4µH), TAP AT 6t FROM COLD END.

L2 – 22t. ON T44-6 (2·0µH)

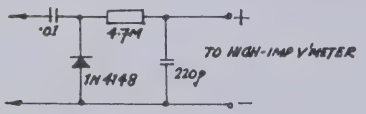
L1 – 20t. ON FT-37-43. OUTPUT LINK, 5t. OVER PRIMARY.

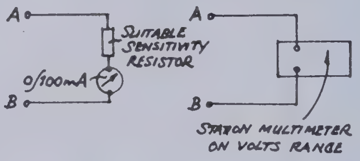
PREMIX-V.F.O. FOR 10·1/14MHZ • matt vokert • **DF4SQ**

High Impedance DC Voltmeter and RF Probe

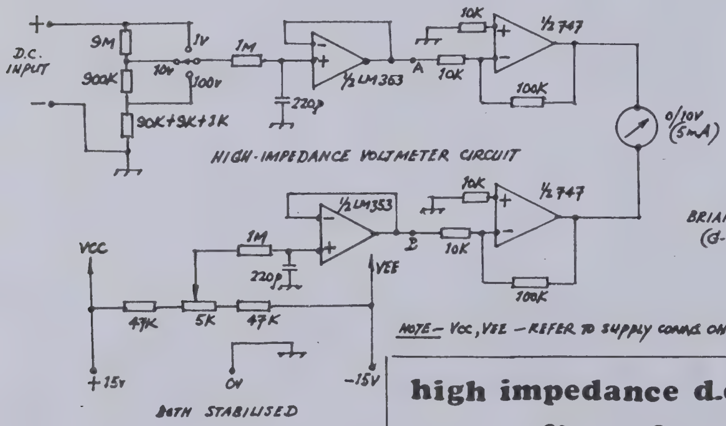
Brian Booth G3SYC

1. All resistors easily available from Ambit (0.5%).
2. 10 megohm input.
3. Ranges 0-1v, 0-10v, 0-100v chosen to suit meter scale available at this QTH, but can change to suit oneself.
4. The circuit is totally conventional and employs a N Fet/Bipolar op. amp. to drive a bipolar op. amp. which operates a relatively insensitive 200ohm/volt 0-10 voltmeter (which I did not want to alter!).
5. Appears to be drift compensated, a few minutes of the XYL's hairdryer on full heat did not alter zero significantly!
6. If you have a sensitive microameter available, ignore cut-off points A and B and substitute (x shunt) see diagram. Alternatively can use the 'station' AVO across A and B if you don't want to play with any meters!
7. Don't know how I've managed without it.
8. Can use lower than plus 15, 0, minus 15 volts power supply if more sensitive meter used, but recommend stabilised supply, (haven't used batteries, expensive and they always let you down when you need the meter most!).
9. Tagboard construction.
10. If you require any further gen, let me know.





A
B
SUITABLE SENSITIVITY RESISTOR
0/100mA
A
B
STATION MULTIMETER ON VOLTS RANGE



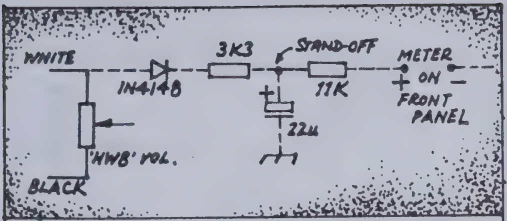
BRIAN BOOTH — G3SYC
(G-QRP-C 478)

NOTE – Vcc, VEE – REFER TO SUPPLY CONNS ON LM353, 747 OP. AMPS

high impedance d.c. voltmeter

& r.f. probe

HW8
S Meter



'S'METER FOR'HW8' ——— G3VTT

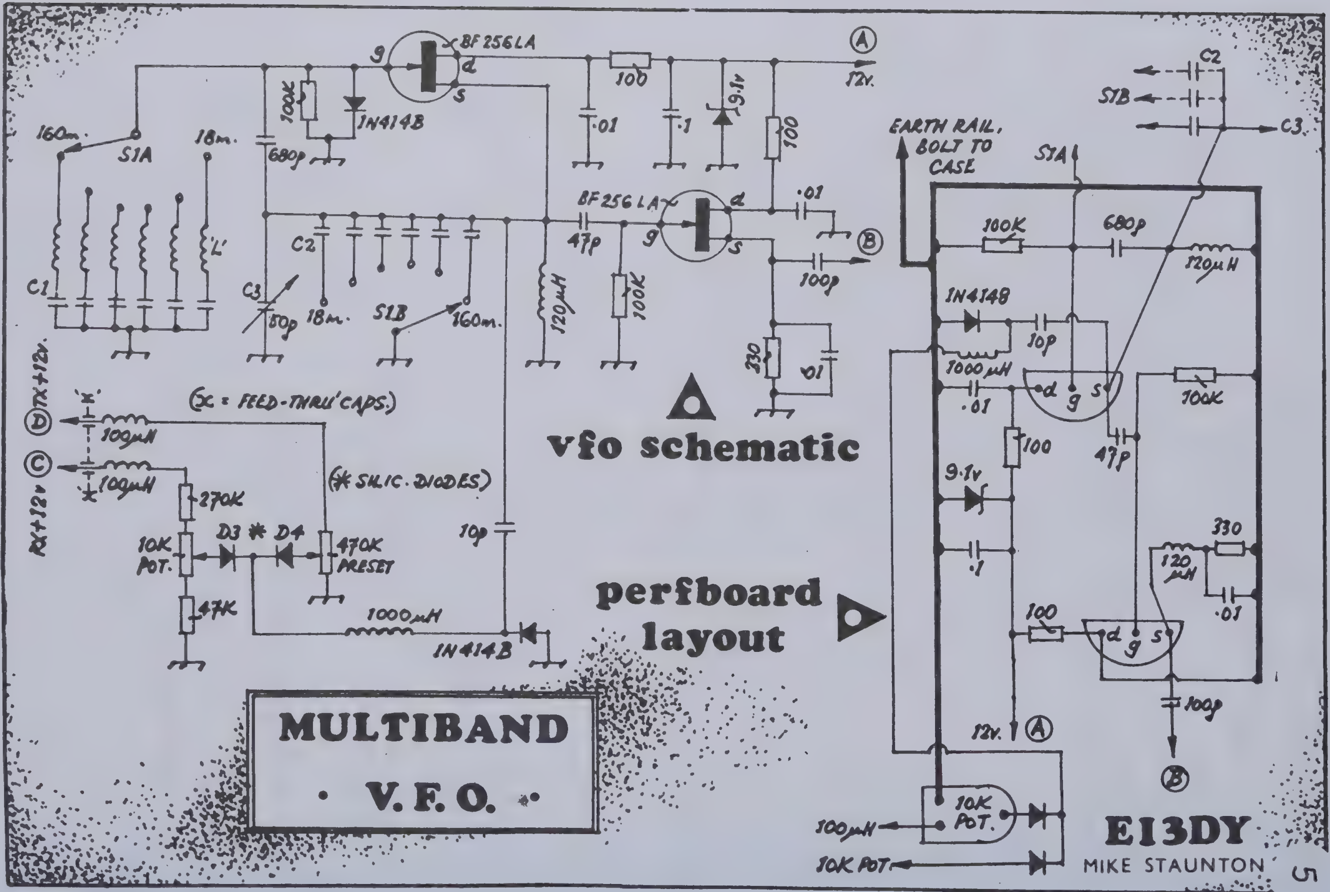
AN 'S' METER FOR THE HW8 (From Benelux Newsletter June 1983, No. 26)

Owners of the HW8 can, by using the circuit shown, obtain an indication of signal strength. Needed are two resistors, 3K3 and 11k, a 1N4148 diode and a 22uFD capacitor.

In the area of the meter a small stand-off insulator is mounted for supporting the components as shown. A connection is made from the AF gain control white lead using the 3K3 resistor and the 1N4148 diode to the stand-off insulator. From the stand-off to chassis earth, a 22uFD is connected, and also from the standoff a connection is made to the meter positive by the 11k resistor. When on receive, a reading is shown on the meter.

From G3VTT - Although this circuit has not been tried here in The U.K., at least to my knowledge, it should give an arbitary indication of signal level by rectifying the audio derived from the top end of the volume control.

This would appear to be a very useful addition to an HW8, our thanks to all the gang in The Netherlands.



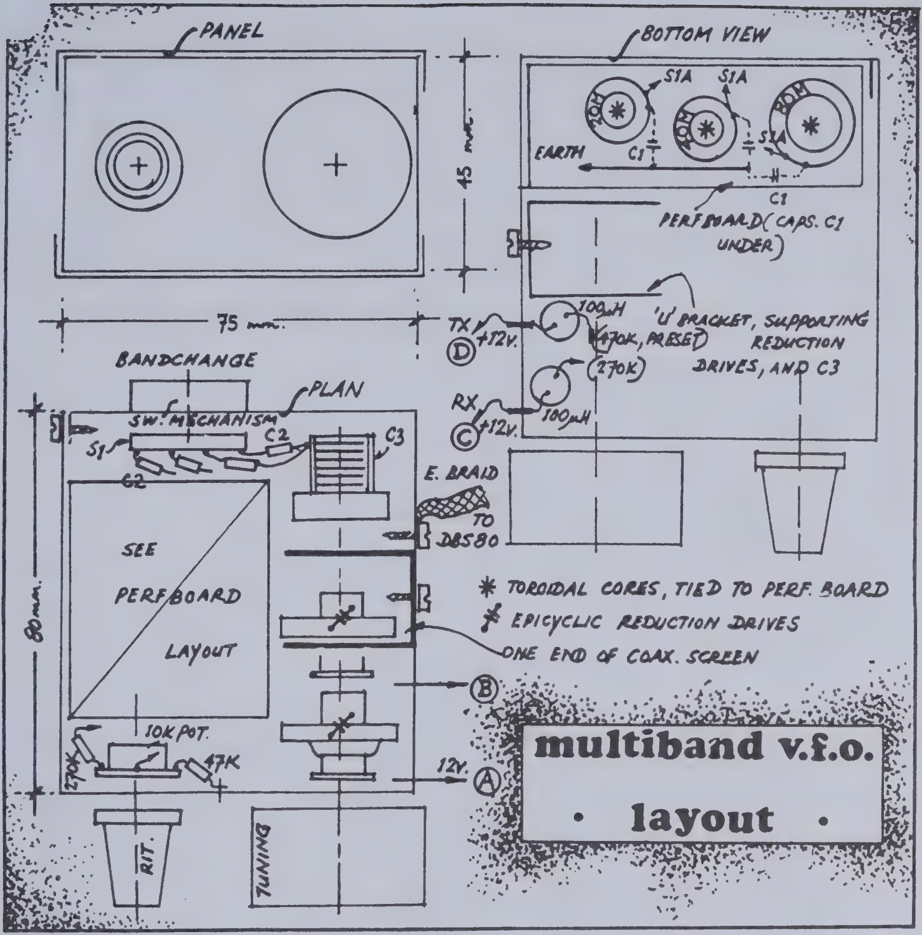
MULTIBAND · V.F.O. ·

vfo schematic

perfboard layout

EI3DY

MIKE STAUNTON



A MULTI-BAND VFO (Suitable for The DSB 80) By Mike, EI3DY

This is a VFO which can be used for more than one band. The schematic owes something to DeMaw and Shriner, QST January 1980, pages 22. Band switching is by means of S1. Tuning is with C3. The VFO automatically offsets on receive for CW operation. This works by placing a capacitor (10pF) and diode, D1, across the tuned circuit. These for a variable capacitance circuit, such that a small voltage change across the diode changes slightly the capacitance across the tuned circuit. This voltage is controlled by the 10k potentiometer. When setting up the circuit the 470k preset is adjusted so that the VFO does not change frequency between receive and transmit when the RIT control is at the DSD position. A robust RF proof box is required. The sides of the writer's box was bent from a piece of aluminium, and all the components were mounted on this. Top and bottom are removeable lids. Two epicyclic drives in series give a professional tuning rate, and stability is excellent. A digital readout is preferable. The PCIM 177 suggested by G3WPO requires a pre-scaler for frequencies above 4MHz, so see Ham Radio Today, October 1983, page 18 for the basis of the circuit to overcome this.

Multiband VFO   EI3DY

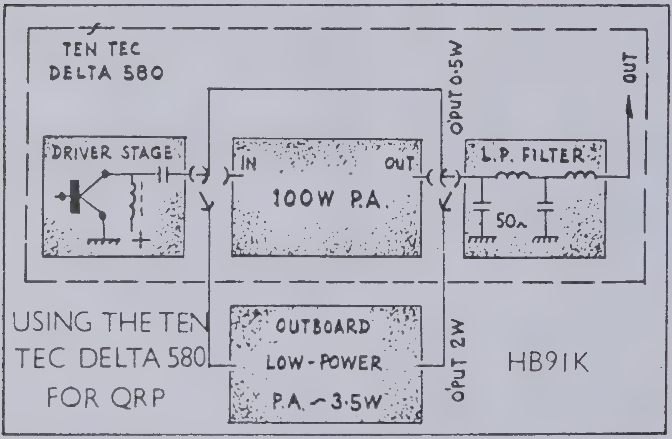
Most of the circuit is on two perforated boards, (calculated component values are given for six bands in the table, but the writer has verified operation with 20, 40 and 80 metres only to date). Just one good earth connection was made between the VFO box and the DSB 80 board. A braid from a TV antenna co-ax was used. All capacitors associated with the tuning portion of the VFO should be polystyrene. The DSB 80 board requires to be modified as follows :- remove TR1, R5 and D2. Change R6 to 27 ohms and substitute an RF choke for R8. Connect a 100k resistor between the gate of TR2 and earth. "A" connects to R6/C8 junction, "B" to the gate of TR2, "C" to R23/R28 junction and "D" to R11/C12 junction.

Parts S1 2 pole 6 way break before make miniature wafer and switch mechanism and BF256LA -Radionics, Dublin. RF chokes, feed through capacitors, Amidon toroid cores and epicyclic drives- Ambit, Essex.

That is the VFO. Modification of the PA stage for all band operation is another subject. DSB 80 experimeters do not forget to share your ideas and circuits.

Band	L	C1	C2
160	126uH: 150 turns No. 34 on T68-2	330	56
80	30uH: 79 turns No. 28 on T68-2	220	56
40	7.4uH: 39 turns No. 26 on T50-2	150	150
30	3.6uH: 30 turns No. 24 on T50-6	120	180
20	1.3uH: 18 turns No. 22 on T50-6	300	180
18	1.1uH: 17 turns No. 22 on T50-6	120	220

(From the IRTS Magazine)

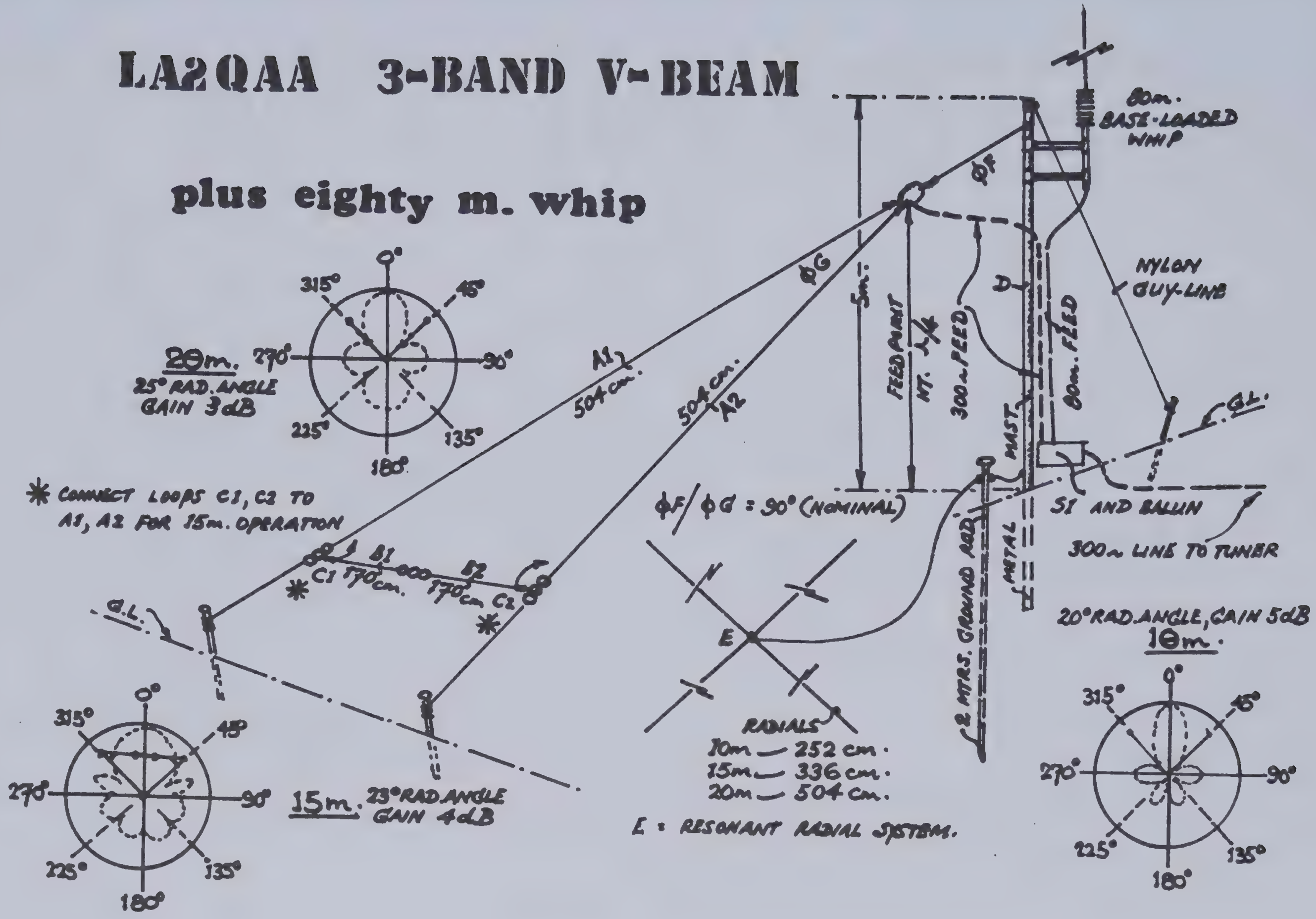


I have bought a new wonderful rig for short wave: The Ten Tec Lelta 580 with really outstanding calm and sensitive receiver, but it delivers 100 watts output. I tried to use it for QRP CW and flash....I found a very simple solution :-

Measuring the driver output impedance, and also the low pass filter impedance input I found both were 50 ohms. All you have to do is to cut the mini coax cable on both in and out of the 100 watts PA, insert some connectors, and feed the low pass filter directly from the driver, and out comes clean, crisp undistorted CW power of about 500mW. This on all bands from 160 to 10 metres.

LA2QAA 3-BAND V-BEAM

plus eighty m. whip



3 Band V Beam *John Hackett LA2QAA*

After having received a positive response ref: "Phased Verticals for Three Bands", (a limited space antenna design for the amateurs with a poor antenna QTH,) I decided to see what we could do for the few who did not understand the phase line system (particularly the 'electrical quarter wavelengths etc). The following antenna should be self explanatory. Again it is aimed at those fo you who have not go a 70 feet tower or about 10 acres of potential antenna park.

Basically what we need is a 17 feet metal mast (or a "metal" tree!). This is important since the mast is the system's reflector. I used two pieces of aluminium tubing, one slotted in the other and fastened with a split pin, the mast is grounded. The antenna radiator is a half wavelength on 20 metres, and one wavelength on 15 and 10 metres. For 15 metres, the lengths B1/B2 are coupled to lengths A1/A2 respectively (coupling system is builders choice). For coupling I used banana jacks and sockets, soldered to C1/C2 and A1/A2. The disadvantage being that you have to dash outside to change bands, the advantage being simply no traps (less loss!).

When one bands a dipole into the configuration shown, several thinhs happen: change of azimuth, change of impedance, reactance etc. in relation to the dipole. For this reason the antenna is fed with 300 ohm open wire line (you can use 300 ohm TV line at a pinch). Also, when changing bands, the same things occurs, change in feed point impedance, etc. Using 300 ohm line through a TT (pye) tuner will match the system to the usual 50 ohm output of the rig. Since the feed point is only quarter of a wavelength over the ground, the antenna behaves like a vertical quarter wave, with low vertical radiation (excellent for DX). Because of this we need a good radial system (extremely important!) to make the system really effective (the more the better!!).

If the SWR is high, by changing the angle between the wires and the mast, and experimenting, the lowest SWR will be found. A moderate SWR is NOT the disaster a lot of amateurs seem to believe. The radials and the mast should be bonded together to an eight feet ground rod. Another advantage of this system is the ease in which you can swing it to any compass point for maximum directivity. If you want a better front to back ratio, just pile in more reflecting wires on the mast behind the antenna. The phased verticals were DX only, whereas this system covers medium and short range contacts as well as real DX. Compared to splashing out a fortune for an aluminium clothesline, or a hassle with the local Council, reference a 50 feet tower, this system is well worth the effort and it is cheap!, though none the less effective for that. Let me know how it goes and good luck. By the way the ambitious members can put their mobile whips on the mast too, feed with the usual coax to a balun and switch.

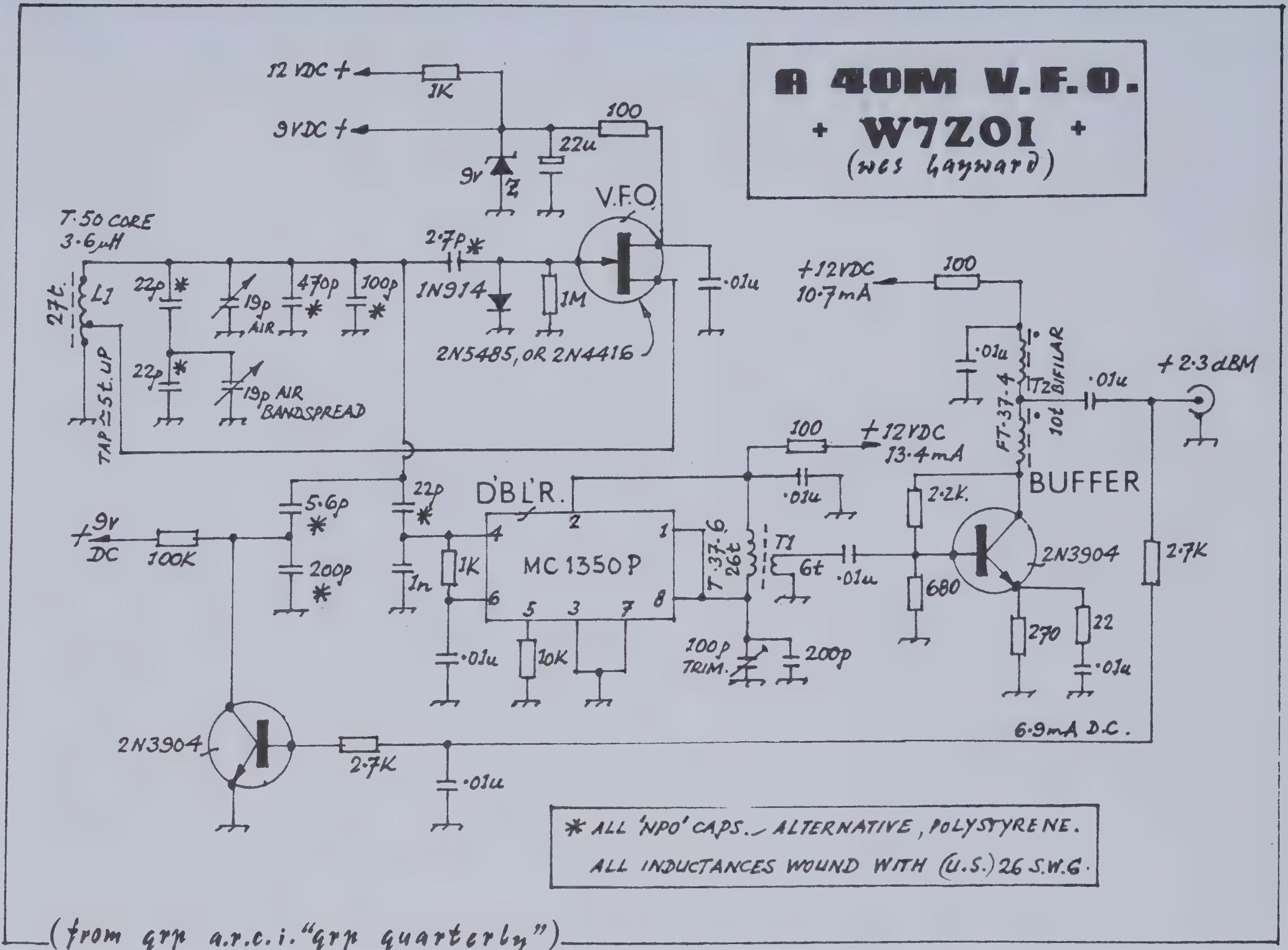
MAJOR RADIO EVENT IN SWEDEN.

The city of HELSINGBORG will be 900 years old in May 1985 and NSRA (Northwest Scania Radio Amateurs) will be 40 years old at the same time. The Swedish Radio Amateurs Society (SSA) will hold its annual meeting in Helsingborg on April 28th 1985. Between 26th-28th April 1985 the Ham Festival "KOM - 85" takes place with a large "hamparty" at a beautiful resturant on the evening of April 27th. The Ham Festival is located in the harbour at the Sound-Oresund facing Denmark. (20 mins ferry to Helsingor - the city of Hamlet). Any G QRP Club members interested in attending this event can obtain further details from Leif Svensson,SM7KWE,Nyborgsvagen 23,S-252 21, Helsingborg. Sweden.

HELP! I am looking for any information on the Argonaut 405 especially RF/Front end (Assembly,Circuit,Re-alignment)Suffering lack of 40/80 drive and cant get one up without the other down! Full costs will be re-imbursed. Mike Hutchins, ZL1BLJ,92 Pah Rd.Howick.Auckland,New Zealand. (ZL1BLJ)

GOOD PRICE PAID for B2 suitcase transceiver. G3NYE, 49 Hawthorn Road, Gatley, Cheadle, Cheshire.

G3RJV is looking for a few valves: 12BA6,12AT6,35W4 and 12A6. Can anyone help?



A 40M V.F.O.

+ W7ZOI +

(wes hayward)

* ALL 'NPO' CAPS. – ALTERNATIVE, POLYSTYRENE.
ALL INDUCTANCES WOUND WITH (U.S.) 26 S.W.G.

(from qrp a.r.c.i. "qrp quarterly")

A 40 METRE VFO By Wes Hayward, W7ZOI (From QRP ARCI "QRP QUARTERLY")

An often asked question is, "Which VFO design is best?". I've built many circuits and have concluded that the exact circuit topology makes little difference. Both thermal stability and noise spectral density have been measured. The circuit must be designed for high loaded tuned circuit Q, and the best components must be used. Then, a Hartley, Colpitts or a Clapp are identical so far as warm-up, drift and overall stability. Low noise results are obtained as well is the stored energy in the tank is maximum.

Perhaps the simplest VFO is the non-critical Hartley, shown in Fig. 1. The low value coupling capacitor from tank to FET gate ensures high resonator Q. The 2.7pF value shown may be replaced with a small air variable cap. The diode shown provides automatic gain control to help establish clean amplitude limiting. The internal FET diode may conduct if the external diode of Fig. 1 is omitted, resulting in thermal instability and high noise. FET type is not critical, although low l-dss types such as some (but not all) MPF-102s should be avoided, for output amplitude may then be low. Motorola 2N5485 is a good, inexpensive choice. The 2N4416 is also great.

Exact inductor value is not critical. A good starting point is a coil with a reactance of 100 ohms, about 2uH at 7MHz. Tap position is also not critical. It should be at about 20% of the total number of turns from ground.

Coil construction is somewhat critical. The best inductors I have found are wound on Amidon -6 toroids. The -6 material has a temperature coefficient of +30ppm/deg. C lower than most ceramic forms, especially those with a tuning slug. The core should be wound with the wire tight against the toroid. Air gaps can degrade thermal stability. Wire size is not critical, but lean towards the larger sizes.

Capacitors can be very critical. The best stability I have observed is with NPO ceramic caps. Herein lies a problem for the amateur experimenter. Good quality NPO caps. are not readily available. I recently purchased some inexpensive imported NPO caps. from a mail-order source. They were used in the VFO shown in Fig. 2 producing a large warm-up drift of 700Hz. Replacement of the 470pF cap. in that circuit with a high quality, domestic unit reduced the warm-up drift to 100Hz. Measurements were made at 7MHz.

If good NPO's are not available, an alternative is the polystyrene cap. They have a rated temperature coefficient of -150 ppm/deg.C. The poly caps, may work very well with Amidon -2 cores which have a positive TC of similar magnitude. Has anyone out there done measurements on this? Incidentally the poly caps. work very well as temperature compensation elements for tuned circuits using -6 cores, air variables, and NPO ceramic capacitors, yielding exceptionally stable oscillators. Poly caps are readily available.

Circuit board layout is not critical, but a single-sided board is preferred. The capacitance of a double-sided board is thermally unstable and has a low Q. Ugly construction (QST, August 1981) also works well.

An output voltage may be obtained from the FET source. A better method is to extract the signal from the resonator via a capacitive voltage divider, yielding lower harmonic content.

All comments regaring component quality apply equally to other oscillator circuits (Colpitts, etc.) and to circuits using bipolar transistors.

Some rigs use VFOs operating at the same frequency as the transmitter output. Others use frequency doublers. Either method will work. However, if there is no frequency multiplication, the VFO must be well shielded from the transmitter output. Stray coupling back to the VFO can cause the output frequency to shift when the transmitter is keyed. Any signal within the 3dB loaded bandwidth of the oscillator tank can have dramatic, and usually undesired, effects. Shield or use a doubler!

The best frequency doublers are those using balance. See the discussion of this in Solid State Design for the Radio Amateur, page 42. The two-diode doubler works very well and is simple. It does take moderate drive power, though. The doubler shown in Fig. 2 uses an MC-1350P integrated circuit. This type is cheap, readily available and offers high gain. It may be driven directly from the oscillator tank through a capacitive divider. The input drive should be confined to about 0.3 volts peak-to-peak. Otherwise, the output power may actually decrease with increasing drive.

The output from the 1350 doubler is low, so gain is required to reach the 1mW (0dBm) level. A 2N3940 feedback amplifier is included in the circuit of Fig. 2. Incidentally, the 1350 works well into the VHF spectrum. I have used them up to 2 metres.

The VFO shwon in Fig. 2 was built for use with a portable 40 metre transceiver (shown in Houston, October 1983). The rig is like the "Micromountaineer" (QST, August 1973) with a built-in crystal. However, it will also operate with an external VFO. The basic VFO operates 3.5MHz. The circuit is configured for use with a direct-conversion portable transceiver with a 800Hz frequency shift activated by a DC voltage in parallel with the VFO output signal. The 5.6pF cap. shown in Fig. 2 may be increased if a larger shift is desired. A 22pF value could be used for a stand-alone transmitter. The VFO should run continuously rather than be turned off during the receive periods.

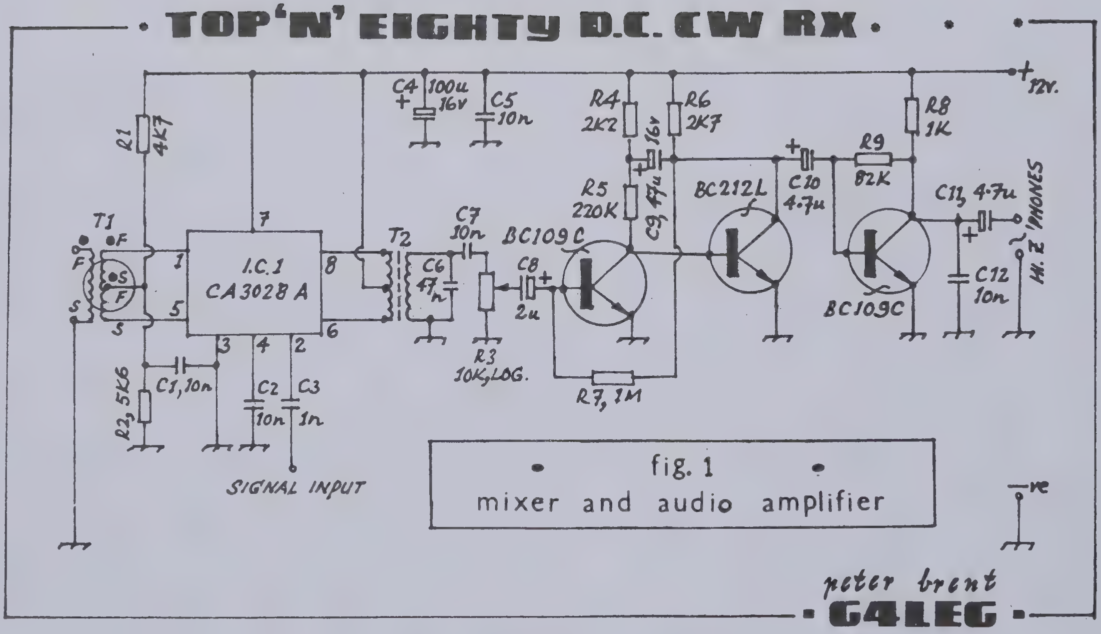
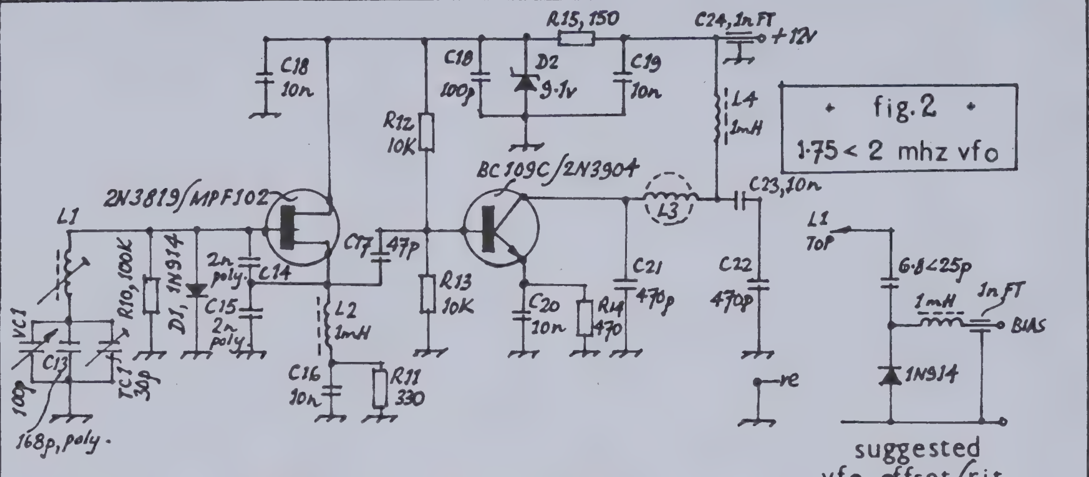


Fig.1. T1: 12+12+12t trifilar on FT37-62 or T37-6 (Amidon) Observe phasing by dots (S=start,F=finish)
T2: 2000 ohms Pri, C.T. to 20,000 ohms Sec.

Resistors: all $\frac{1}{4}$ watt 5%

Capacitors: All 10nF disc ceramic 30v. pf values are ceramic except where noted (poly=polystyrene)

VC1 100pF airspaced (Jackson U101), VC2 365pF dual section (Jackson 02), TC1 30pF (Jackson C303) trimmer or similar.



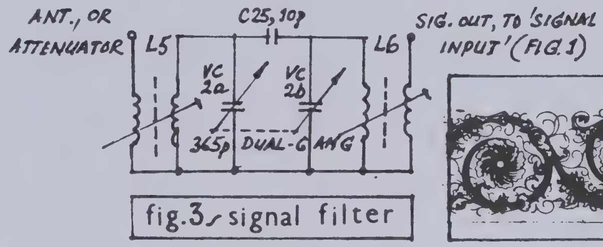


Fig.2. L1: Cambion 2060-06 (28-63uH nominal) L2: 1mH RF Choke
L3: 24t closewound on T50-2 (Amidon) L4: as L2.

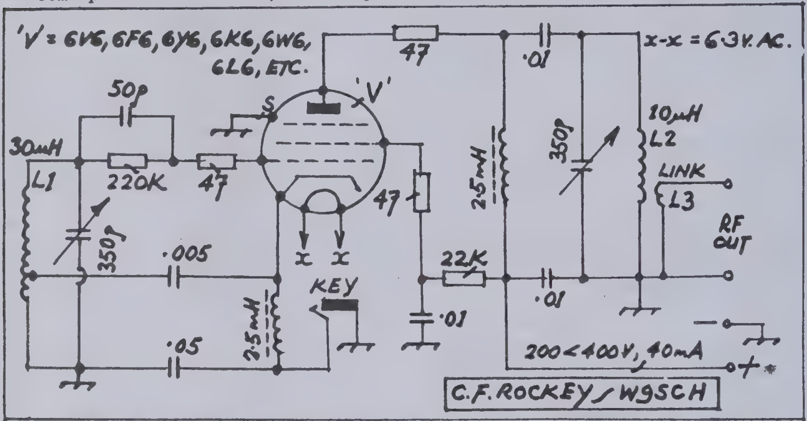
Fig.3. L5: Denco Range 3 Blue (27.6uH nominal, antenna coupling winding.
L6: Denco Range 3 Yellow (27.6uH nominal, interstage coupling)

NOTES ON THE TOP 'N EIGHTY RECEIVER BY G4LEG.

Construction:
1) VFO: build in separate shielded box, screened output.
2) Mixer/Audio: If on same PCB, use guard strip under T2, observe symmetry on VFO feed to aid balance. Audio stages are high gain so use good layout.
3) RF Filter: Use reduction drive on VC2, 80m breakthrough results if not correctly peaked on 160m, To align: adjust cores with VC2 fully meshed, for peak noise, or use signal source.

Operation:
VFO is fundamental for 1.75 to 2.MHz; VC2 peaks 2/3 to 1/2 open for this band. VFO second harmonuc used for 3.5 to 4.0 MHz, VC2 peaks about 3/4 open for 80m. For transceiver use, key 12v to mixer/AF in receive condition. For separate use, wire 12v to mixer/AF; use RIT/Offset. Zerobeat with station, offset RIT for beat note, Return RIT to zerobeat to net TX.

Audio Filter:
o.22uF across phones socket after C11 peaks at 800Hz with S.G.Brown phones. Use 88mH parallel with o.47uF from junction of C7/R3 to ground.



OLD-TIMERS' JUNK-BOX RIG

This little rig puts out about five watts, and was built from my junk box. Unlike the typical simple oscillator, this rig is really two stages in one set of tube elements: a triode Hartley oscillator and a tetrode multiplier. It is thus more stable and more isolated from load variations than the simple oscillator would be. The Hartley oscillator is tuned to 160 metres and the output is tuned to 80 metres for best output. An entenna tuner is recommended for increased harmonic attenuation. This rig puts out a very stable signal if it is built sturdily. Use a well filtered power supply of about 350 volts at 40mA, for five watts out.

I would like to hear from anyone who builds this little rig.

V1 - 6V6, 6F6, 6Y6, 6K6, 6W6, 6L6, or use what you have.
L1 - 30uH. 35 turns of No. 20 AWG on a 2⅜ inch former, tapped 7 turns from ground.
L2 - 10uH. 10 turns of No. 20 AWG on a 2⅜ inch former.
L3 - 1 or 2 turn link over the ground end of L2
Resistors are all 1 watt carbon. Fixed capacitors are either mica or ceramic.
L1 and L2 should be mounted at right angles and six inches apart.
Nothing is really critical, use what you have but build it sturdily!

A BI-DIRECTIONAL MIXER

By Mike Koblic GW4GIU

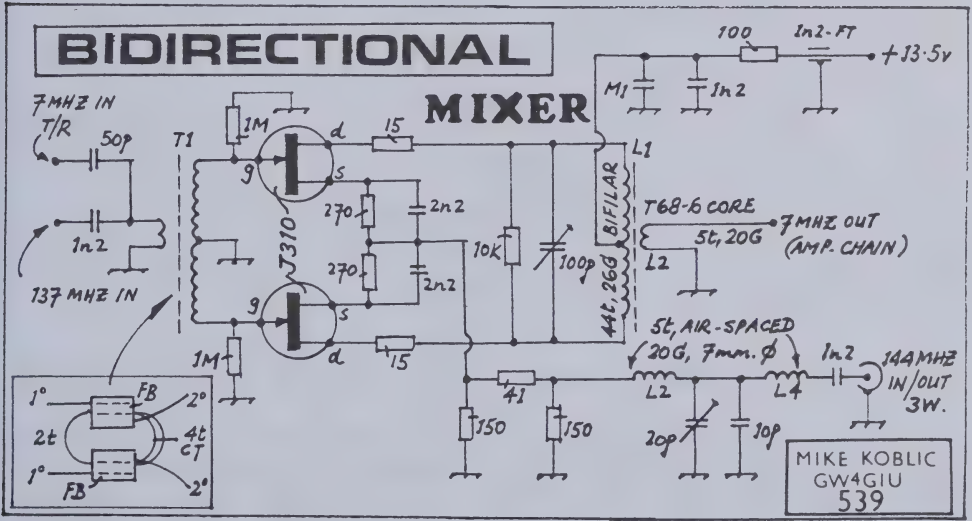
The nucleus of my station is an IC202 with three converters for 14, 21 and 28MHz, and a separate homebrew transmitter for 14 and 21 MHz. I have recently been successful with a transverter for 28MHz, which enabled me to work Europe on SSB and 3B9FK on CW with one watt out. I then decided to try and extend my range to the lower bands.

In the process I got interested in building a bi-directional mixer. The ideal choice is, of course, the SBL-1. However, like you, I believe that part of the art is building cheap, preferably junk box equipment, and to my mind the SBL-1 hardly fits the bill. I tried various combinations of diodes and home-made transformers, but with disappointing results.

I decided to abandon this approach and return to the more tested approach with two balanced FETs (picked up in handfuls at rallies). The result is shown in the diagram. The two 15\ resistors in the drains have been drawn in as an afterthought - insurance for stability. The 6dB pad is needed to reduce the full output of the IC202 to safe levels, and in theory should significantly reduce the sensitivity in the receiving mode. However, the sensitivity was superior to any of the diode rings tried before and, interestingly there was no tendency to overloading, which my FET based up-converter for 14MHz suffers from on occasions.

The 137MHz signal is derived from a 50p crystal, a 45.7Mz, with a multiplier and amplifier chain. With the older type of IC202, without side-band selection facility, the oscillator should be on the higher side of 144MHz if SSB operation is desired.

The whole project was built on a single sided PCB, using the "lino cutter" technicque (components same side as foil). I believe that the most expensive item is the T-68-6 core. I would be interested in any other ideas on bi-directional mixers.



ANOTHER USE FOR THE SWR INDICATOR

By Bill Tillett, K5CVK

(Reprinted from June 1982, QST)

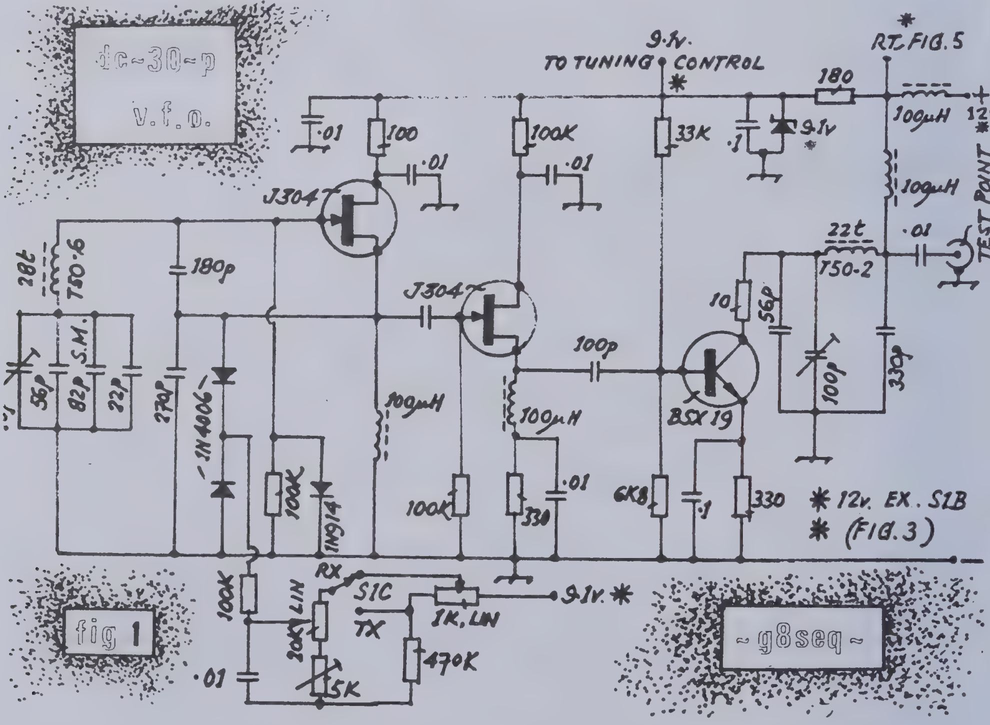
An SWR indicator can be made to double as a field strength meter simply by disconnecting it from the transmission line and plugging a length of wire into the transmitter input. Relative field strength can be read with the meter set in the forward position.

I used mine to tune a two metre mobile amplifier for maximum output. With a 19 inch piece of stiff wire in the coaxial jack, and the meter sitting on the car hood, I was able to adjust the amplifier quickly and easily.

THE DC-30-P TRANSCEIVER

The DC-30-P TRX originated in South Africa, Graham ZS6HV being the principle designer. The version shown here is an Anglicised version, developed as a club project for the COVENTRY AMATEUR RADIO SOCIETY by G8SEQ. Kits are available from him.....see ad.

DC-30-P OFFER: Double sided PCB and construction notes £6. Kit of parts, less box £35, full kit £40. These prices include U.K. postage and packing. Overseas members please write for price quote. Also available, DC-40-P and DC-80-P, same price. Three band kit, covering 80, 40 and 30 metres £55, full kit only. Send orders to G8SEQ at 14 Hollow Crescent, Radford, Coventry, CV6 1NT.



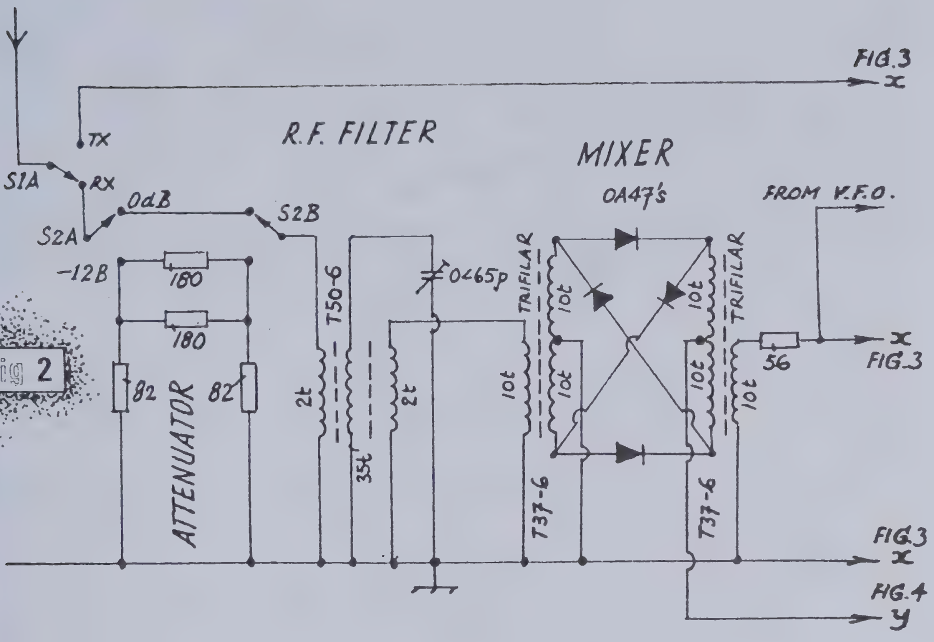


FIG.3
x
TX
R.F. FILTER
MIXER
S1A
RX
OA47's
FROM V.F.O.
0dB
S2B
S2A
-12B
180
180
0<65p
T50-6
TRIFILAR
10t
10t
10t
10t
TRIFILAR
56
x
FIG.3
82
82
ATTENUATOR
2t
2t
35t
10t
10t
10t
T37-6
T37-6
FIG.3
x
FIG.4
y

fig 2

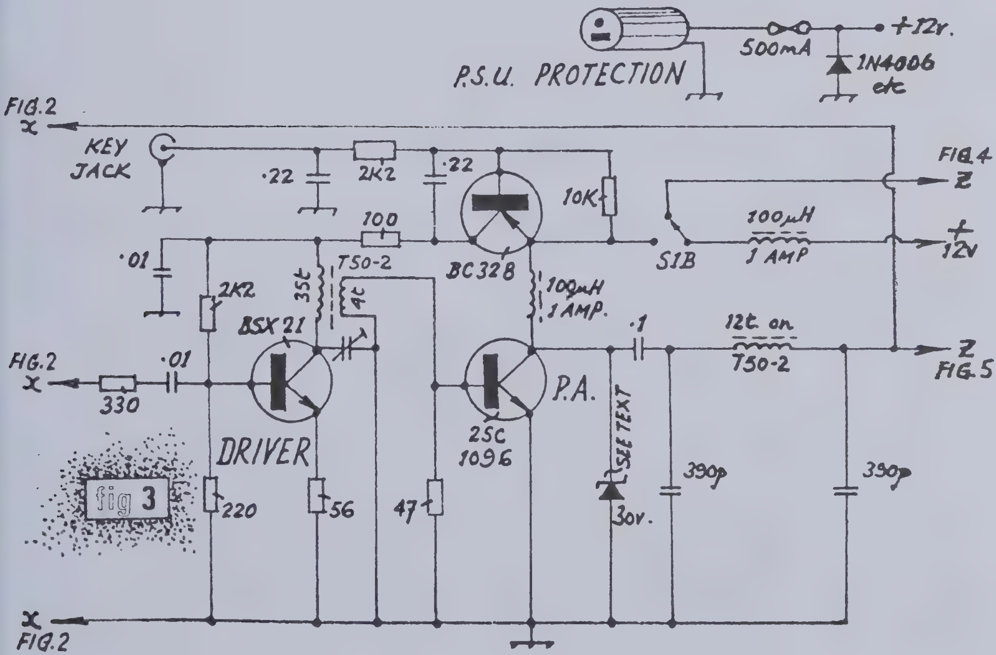

500mA
+12v.
1N4006
etc
P.S.U. PROTECTION
FIG.2
x
KEY
JACK
·22
2K2
·22
10K
FIG.4
Z
100μH
1 AMP
+12V
100
·01
T50-2
BC328
S1B
35t
4t
2K2
BSX21
100μH
1 AMP.
·1
12t. on
T50-2
Z
FIG.5
FIG.2
x
·01
330
P.A.
SEE TEXT
2SC
1096
DRIVER
390p
390p
220
56
47
30v.
x
FIG.2

fig 3

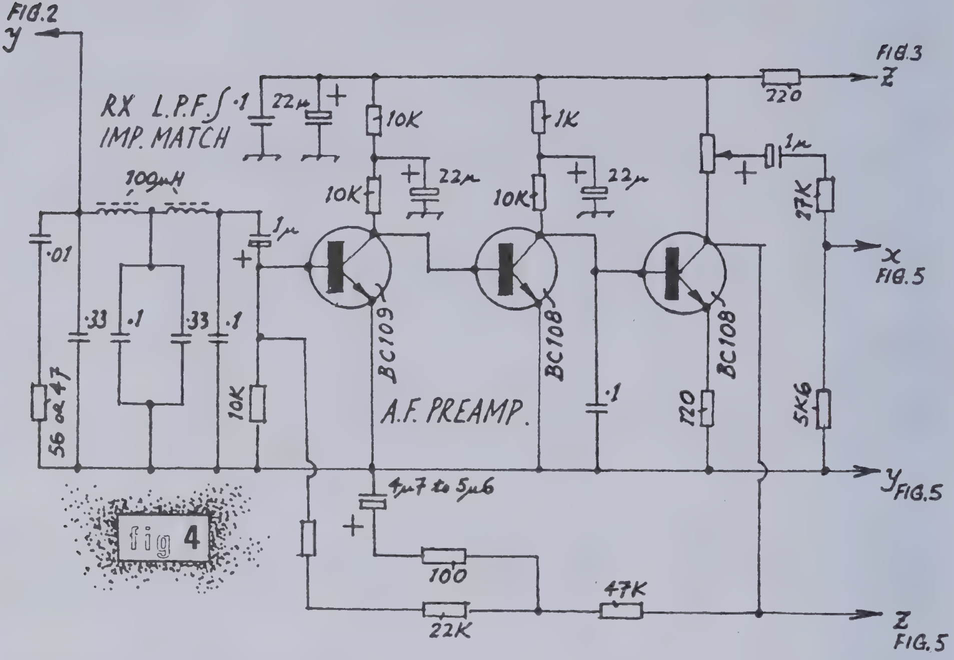


FIG.2
Y
RX L.P.F. ∫ ·1
IMP. MATCH
22μ
10K
1K
220
FIG.3
Z
100μH
10K
22μ
10K
22μ
1μ
1μ
27K
·01
X
FIG.5
·33
·1
·33
·1
BC109
BC108
BC108
10K
·1
120
5K6
56 or 47
A.F. PREAMP.
Y FIG.5
4μ7 to 5μ6
100
47K
22K
Z
FIG.5

fig 4

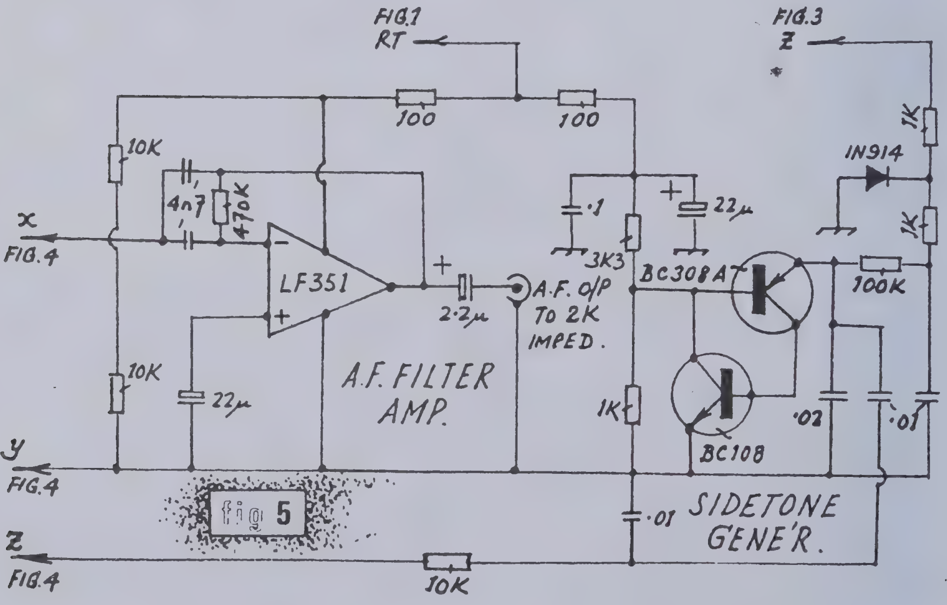


FIG.1
RT
FIG.3
Z
100
100
1K
10K
IN914
4n7
470K
·1
22μ
X
FIG.4
1K
LF351
3K3
BC308A
100K
2·2μ
A.F. O/P
To 2K
IMPED.
10K
22μ
A.F. FILTER
AMP.
1K
·02
·01
BC108
Y
FIG.4
·01
SIDETONE
GENE'R.
Z
FIG.4
10K

fig 5

A DIODE PEAK DETECTOR FOR QRP

GRAHAM LAMBERT ZS6HV

Most radio amateurs have a power meter in their shacks with a full scale range of 1KW. Such a meter would hardly lift off the stop with an input of one watt! In QRP work it is useful if one can accurately measure the output power. In some contests it is esential to have the facility to measure the output of the little rig.

Using either a multimeter, DVM or a 500uA meter, the diode peak detector described in this article is easily constructed and provides accurate power level measurement.

Take care to wire the two 100 ohm resistors, (or two 150 ohm resistors if a 75 ohm input is required), with very short leads directly across the socket.

The circuit is directly coupled, and so can be calibrated by using a battery in a potential divider configuration, providing the input signal is greater than one volt. The circuit will be accurate well up into the VHF bands if good construction techniques are used.

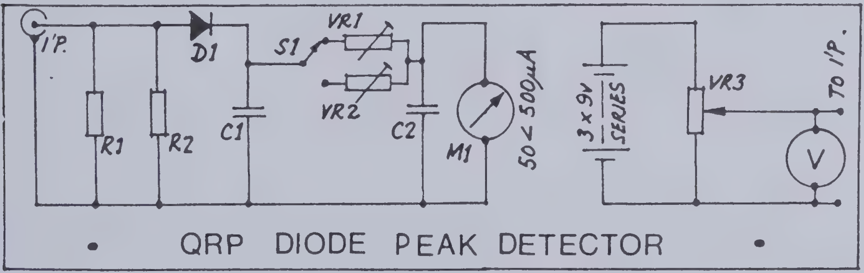
Caibration is carried out as follows:- set VR3 to give 10V and with S1 in the 10V position, adjust VR1 so that M1 reads full scale. With S1 in the 15V position set VR3 to give 25V and adjust VR2 so that M1 reads full scale. The QRP power meter is now calibrated to read peak voltages accurately.

The relationship between this reading and the output power is as follows:- P=VxV/R where V=RMS volts and R=dummy load resistor. Peak voltage is 1.414 RMS voltage and therefore VpxVp=VRMS and VpxVp/2R=P, where Vp=Vpeak or Vdc as calibrated. For example, a 50 ohm system and 10V peak would be P=10 x 10/2x50 which is 1W. Full scale deflection is equal to one watt. Half scale deflection i.e. 5V is P=5x5/2x50 which is 250mW. Full scale deflection with S1 in the 25V position is P=25x25/2x50 which is 6.25W.

The author has built the instrument, calibrated it on a battery as described, and compared it with laboratory equipment and found it to be accurate within 5% from DC to 1GHz. With a 50uA meter, accurate readings can be made as low as 50mW. Below this value the diode becomes non linear and the scale on the instrument will have to be calibrated and marked by hand.

PARTS LIST:

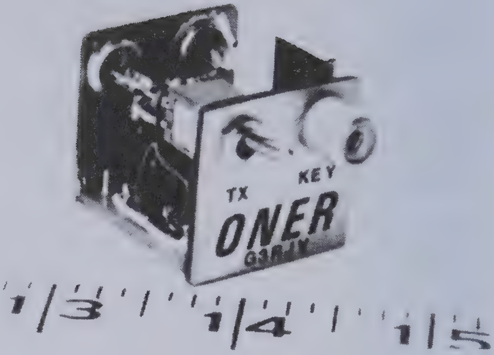
R1,R2	2W carbon (100 ohm or 150 ohm each - see text)		
D1	1N914 or 1N4004	C1,C2	0.01uF ceramic
VR1	preset 270K	VR2	reset 500K
VR3	potentiometer 10K-1M	S1	switch.



ONER

THE H.F. BANDS TRANSMITTER
ON A ONE INCH SQUARE P.C.B.

GEORGE BURT GM3OXX

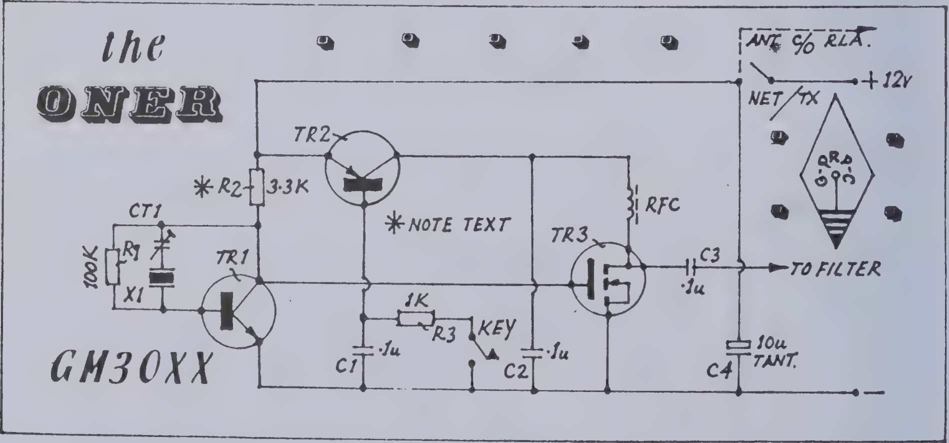


By George Burt GM3OXX

The Oner is a small transmitter built on a one inch square PCB that gives at least 1 watt output to 10MHz. It is useable on 14MHz at a reduced power output of some 750mW.

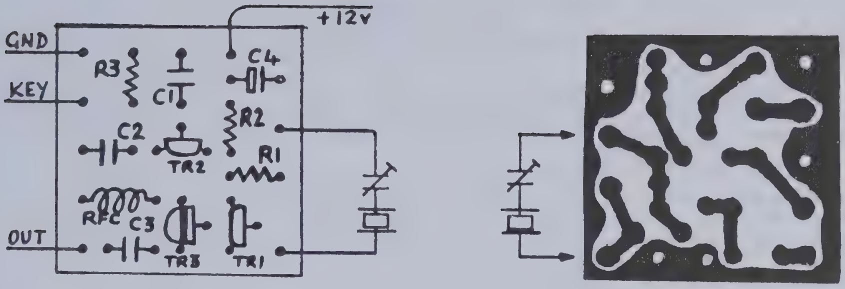
R2 (3.3K) in the circuit is the collector load of TR1, and also sets the bias for TR3. It is possible to reduce the value as low as 1K to squeeze more power from TR3, but care must be taken not to cook the PA! Beginners stick to 3.3K!! (I get well over two watts out of my Oner on 80 metres with 3.3K - G3RJV.)

Construction notes - the only real problem was pushing six veropins into such a wee board!, and trying to find the PCB after laying it down!!

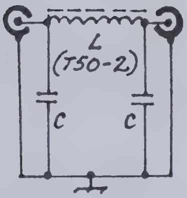


TR1 = ZTX651 TR2 = ZTX751 TR3 = VN10KM (all availabke from R.S.)
RFC = as many turns of 30SWG enamelled wire as will fill a small ferrite bead, usually 10 to 12.
CT1 = trimmer for frequency offset about 60pF.

Results - with a single section filter, ATU and a 44 feet Zepp, lots of good QSOs have been had on 3.5, 7 and 14MHz. Now no one has an excuse for not getting started in QRP.



TOP PCB (ACTUAL SIZE) BOTTOM



FILTER VALUES			
80m	750p	750p	21t
40m	470p	470p	14t
20m	210p	210p	12t

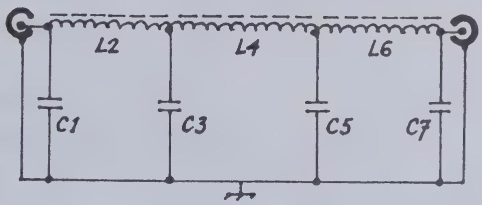
FILTERS AND THINGS

A simple transmitter like the Oner requires a low pass filter to reduce the harmonic output. If the Oner is used with an ATU, a simple filter like the one on the left, wound with 22SWG wire, will serve the purpose. A better solution is to use a seven element filter, designed by W3NQN from the table below. The toroid formers can be had from TMP Electronic Supplies, Unit 17, Pinfold Workshops, Pinfold Lane, Buckley, Clwyd, CH7 3PL, (Tel: 0244.549563).

Seven Element Low Pass Filters

C1/7	C3/5	L2/6	L4	Wire	Band
470pF	1200pF	25t	27t	28SWG	80
270pF	680pF	21t	24t	26SWG	40
270pF	560pF	19t	20t	26SWG	30
180pF	390pF	16t	17t	26SWG	20

C1 = C7 C3 = C5 L2 = L6
80 metres inductors on T-37-2 cores
40+ metres inductors on T-37-6 cores



CRYSTALS Fundamental amateur band CW crystls are available on the International QRP frequencies: 3560, 7030 and 14060 from P.R. Golledge Electronics, Merriott, Somerset, TA16 5NS. £3.50 each inc. VAT and postage for G-QRP-CLUB members, £4 to non-members.

CHEAP HI - Z HEADPHONE IDEA

GEOFF POLLITT G4NPQ

Recently I required a small lightweight pair of phones for a portable transceiver for holiday use. Most of the transceiver circuits in SPRAT require high Z phones. These are not common and most of the surplus ones around are heavy and bulky.

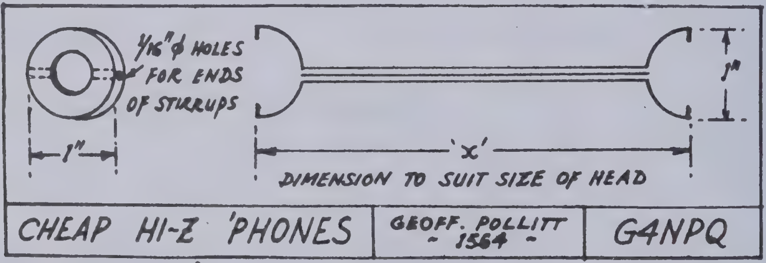
It was noticed at many of the recent radio rallys that large numbers of high Z microphone inserts were being offered, at prices between 20p and 50p. These inserts are made of aluminium, about 1 and an 1/8" diameter and 5/16" thick. They have numbers printed on the back, OL56002 and CDL 9/75. This last set of numbers varies and seems to be the month and year of manufacture. The DC resistance is about 700 ohms, and impedance is over 1K. They are, I believe, the mike/phone inserts from surplua Pye Bantam or similar transceivers.

A number of the inserts were bought and tried as earphones, and the results were very good. The audio response seems ideal for CW, and the sensitivity was good.

The headband was made by soldering three pieces of springey wire together, side by side, see the sketch. Paxolin washers, 1" diameter and 1/4" thick were cut out and glued onto the back of the inserts with epoxy adhesive. Rough up the aluminium with emery paper to provide a good key for the adhesive.

1/16" holes are drilled in the edge of each washer to take the ends of the "stirrups". The inserts are wired in series, and connections to the leads projecting from the inserts are made inside the 1/2" diameter holes in the centre of the washers. The holes are then filled with epoxy and this both insulates the connections and secures the leads.

To finish off the phones, thin sponge pads can be stuck on the front and trimmed off. Dimension x is best obtained by measuring over the head with a tape measure, "earhole to earhole". The finished item is a pair of lightweight 2000 ohms phones, costing £1 or less. The inserts are available from J. Birkett of Lincoln.


1/16"ϕ HOLES FOR ENDS OF STIRRUPS
1"
1"
'X'
DIMENSION TO SUIT SIZE OF HEAD
CHEAP HI-Z 'PHONES
GEOFF. POLLITT
~ 1564 ~
G4NPQ

Paxolin "washer"
1" dia. 1/4" thick
1/2" dia. hole
2 off required
glue to back of
inserts

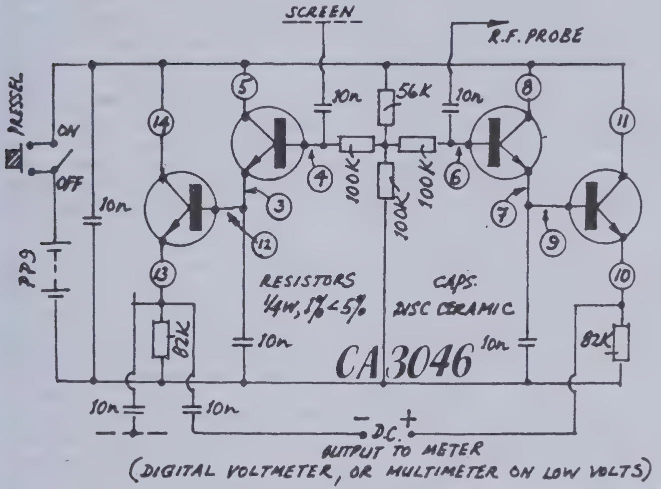
3 pieces 1/16" brass "brazing rod" or similar springy wire, laid side by side and soldered together at intervals. Centre piece cut short, and outside pieces bent to form stirrup shape to hold phones. Thread sleeving over wire before bending to pad headband.

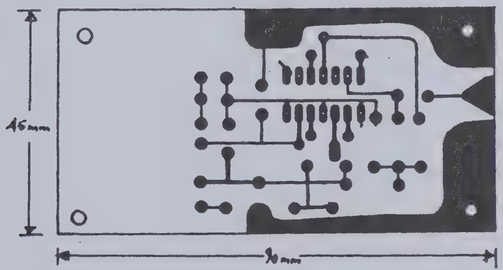
A PEAK READING R.F. PROBE   R.F.LYDDON   G4ETJ

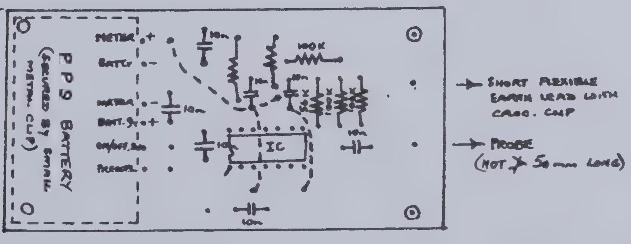
The probe measures from 5mV up to 4 volts maximum, and covers frequencies up to 100MHz, (response down 6dB at 120MHz). There is no DC offset adjustment, (but it can be minimised by accurate matching of resistors and a good quality IC). The current consumption is less than 1mA, and the input impedance is 50Kohms in parallel with 3pF.

It is constructed in a small screened case with a short probe tip and no IC socket, solder CA3046 direct to the PCB.

Peak Reading RF Probe — G4ETJ







→ SHORT FLEXIBLE EARTH LEAD WITH CROC. CLIP

→ PROBE (NOT > 50mm LONG)

– – – – LINKS ON FOIL SIDE

ROCK´S FISHING BOX

A pragmatic one watt station for 40 and 80 metres CW

By C.F. Rockey W9SCH

The rules for The Suitcase Competition, (Spring 1984 Sprat), specify that the rig shall be contained in a "suitcase, briefcase or other common object." Now, since every Wisconsin male, (and female too!), fishes, a "fishing box" is a common object indeed in these parts.

The box in reference is actually a metal tool box, measuring 5.5 x 5.5 x 12.5 inches. These are most often used for carrying reels, hooks, sinkers, lures and other piscatorial gear, (often also a bottle of "Kentucky Antifreeze" against dawn chills or a possible snake!). The box is equipped with a handle on the top for easy carrying and sometimes even an embossed inch scale for measuring the catch. Mine is made of sheet steel, (recommended for radio purposes), rather than the plastic ones now becoming common, but are inferior for this use.

The transmitter is built into the lower or main body part of the box. The receiver is built into the lid, (which, when open, forms a pan about 1.5 inches deep). There is room within the lid also to strap in two six volt lantern batteries, (I do not use these, rather I use my external regulated 12 volt supply on all my solid state gear). The rules also specify, "modern techniques". This rig is solid state which, I believe, satisfies these requirements.

I use, what Wes Hayward calls, "ugly construction" in this rig, rather than circuit boards. Not that I am against circuit boards, it is just that it does not fit my philosophy as it were. When I build a piece of ham gear, after deciding on basic objectives, I start with the oscillator and let it grow from there. Some people plan things down to the last detail before begining, but my small brain doesn´t work well that way, (I guess I am what they call "aristotelian" rather than "caretesian" in these things). Furthermore, my method permits me to check the operation of each stage as completed. This is a big help in de-bugging, and is good for one´s moral. In this rig I use the bottom (or inside top) itself for the common ground plane. Transistors and other "hot" items are supported in insulated tie strips. This makes a solid job and is attested by the fact that the rig may be dropped three feet onto a wooden floor without breaking anything loose; it will work perfect;y thereafter (my electronics students used to call this the "....ivity test". This rig has "....ivity".

The transmitter circuit is straight forwardand and seems to work as intended on both 40 and 80 metres with a minimum of fuss. Aside from basic orderliness, no attempt was made to either miniature or beautify the rig. There is no doubt that some of the latest tricks would improve things, but I did it my way!, and make no apology for this.

The schematics specify the types of trnsistors I would buy if I were to go out and buy them. But, in fact, I actually used such motley units as I had on hand, begged, bought and stolen over the years. Likewise, the other parts; very little is critical. I purposely avoid tricky circuits that require more than ordinary care in constructing or adjustment. This is a rig for us simple souls....

The receiver is a direct conversion job of the simplest sort. I admittedly stole the AF amplifier circuit from Sprat, probably G3OXX. The transistors used were salvaged from a discarded industrial control device and, aside from being NPN types, are otherwise unknown. But they seem to work well in this application, despite their questionable ancestory. Perhaps some people would require three audio stages, but we found two to be adequate when a good pair of magnetic high Z phones are used.

Not having IC chips to hand, and not wishing to buy any, (George Burt and his Scottish ancestory friends will understand this!), I first tried a simple diode mixer; it worked, just as old Papa Fessenden predicted in 1905, but was tricky, particularly with respect to oscillator injection. It also put out too much RF into the antenna in receive position, not good....so, we went to a junction FET; several arrangements were tried, but the one diagrammed seemed to be the best found. The oscilllator voltage is injected through a "gimmick", (Americans are fond of "gimmicks"), which is just a very small adjustable capacitor of a microfrarad or two. Twist two pieces of insulated hook up wire together until the sensitivity seems best, that´s all!

The transmitter produced one watt of clean, chirpless output on both 40 and 80 metres. This is genuine QRP, yet adequate for reasonably consistent results. Under good conditions we have had many long "rag chews" with one watt, and the signal strength still impressed those without QRP experience.

None essential features such as side-tone, SWR bridge, QSK etc., are not included as I do not find these necessary to my life style. (In "transmit" condition a soft hum is heard in the phones when the key is pressed, and this is sufficient for good sending, I find.)

The receiver permits you to hear almost anything you are normally likely to work with one watt input. Headphone volume is comfortable, (if you need more, add another AF stage). Indeed, the volume is equal to that experienced with those good old 0-V-1 receivers that I grew up with. As with any simple receiver, the main selectivity is contained between your own ears. This is sufficient in my case; when the QRM is too bad, one watt hasn´t much chance anyway. I admit that at times those powerful BC stations on 40 metres butt in at night, but so they do on classier receivers too, (I avoid this by using 80 metres at night).

Considering its simplicity and low cost, this little rig was, for me, very much worth building; it might be so for you too, "´tis a gift to be simple...."

Notes on Parts Used, etc.

1. I used half or one watt carbon resistors as I had on hand, quarter watt units would do in most places.
2. Use "driftless" silver mica capacitors in criticial spots in the oscillaltor circuits. Other RF by-passes may be ceramic, or even old micas.
3. The VFO tuning capacitor must be air dielectric. Use a slow motion "vernier" dial on it for easy tuning. The driver and final amplifier tuning variables may be these little mica variable ones made by the Japanese for BC receiving tuning. Being about 350pF maximum capacitance, they cover both bands satisfactorily, 80 metres nearly full capaitance and 40 metres at about one third "in". The same is true of the receiving tuning capacitor, (these are still available on the market).
4. The toroids are some pre-wound things I picked up cheap at a ham "flea market". These measure between 6 and 7 microhenries. The small ones are half inch and the larger ones are three quarters of an inch outside diameter approximately. The small ones are wound full of (US guage) No. 26 enammeled wire and the large one wound full of No.22 wire. These are tapped where specified on the schematic diagram. Tap positions are not highly critical.
5. The oscillator coil is wound on a half inch iron slug former, half inch diameter. It is wound to a winding length of 9/16 inch with No.24 enammeled wire, tapped 1/6 of the way up from the earthy end.
6. The secondary windings on the driver and final amplifier coils are best set up by individual experiment to provide the best output, (the values I suggest are approximate and may not be the best in your case, they are for guidance only).

I use a simple 80 metre centred "Zepp" antenna, 25 feet high, and with this rig 200 to 500 mile contacts are routine with one watt, further on a good night.

ROCK'S FISHIN' BOX

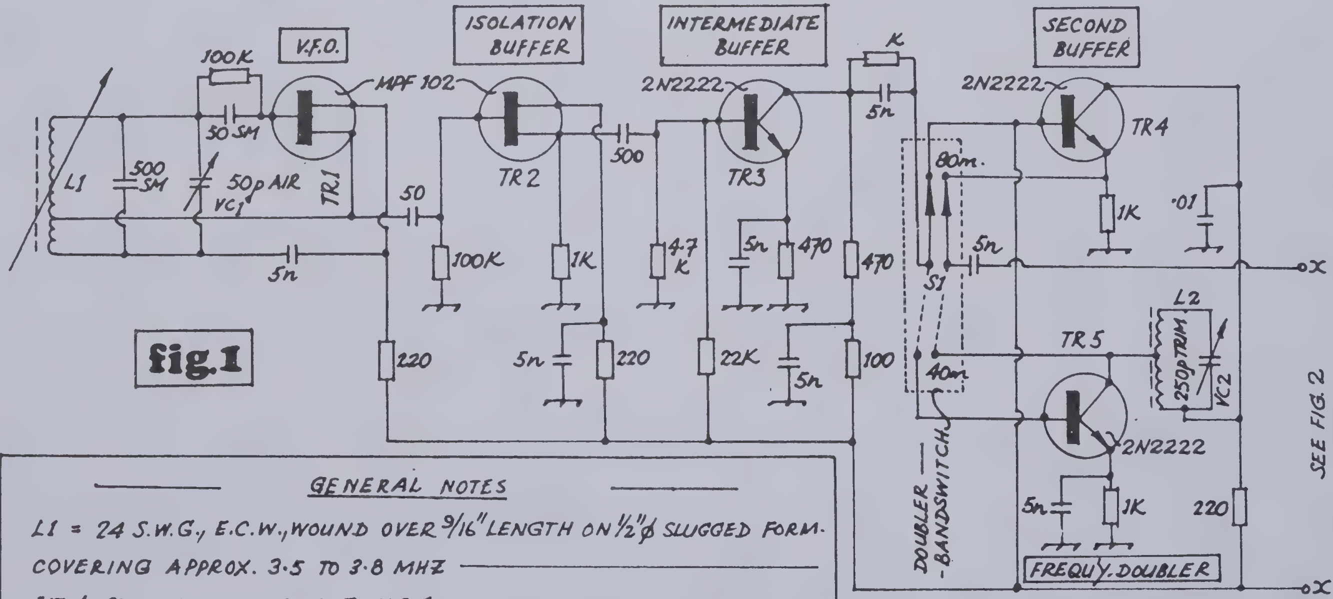


fig.1

GENERAL NOTES

L1 = 24 S.W.G., E.C.W., WOUND OVER 9/16" LENGTH ON 1/2"ø SLUGGED FORM.

COVERING APPROX. 3·5 TO 3·8 MHZ

FIT A SLOW-MOTION DRIVE TO V.C.1

DOUBLER BANDSWITCH IS A 2-POLE, 2-WAY "KNIFE" TYPE

L2 IS A SMALL TOROID, C.T. WINDING. TUNE TO 7·1 MHZ, VIA V.C.2

• W9SCH •
ALBANY, WISCONSIN, U.S.A.

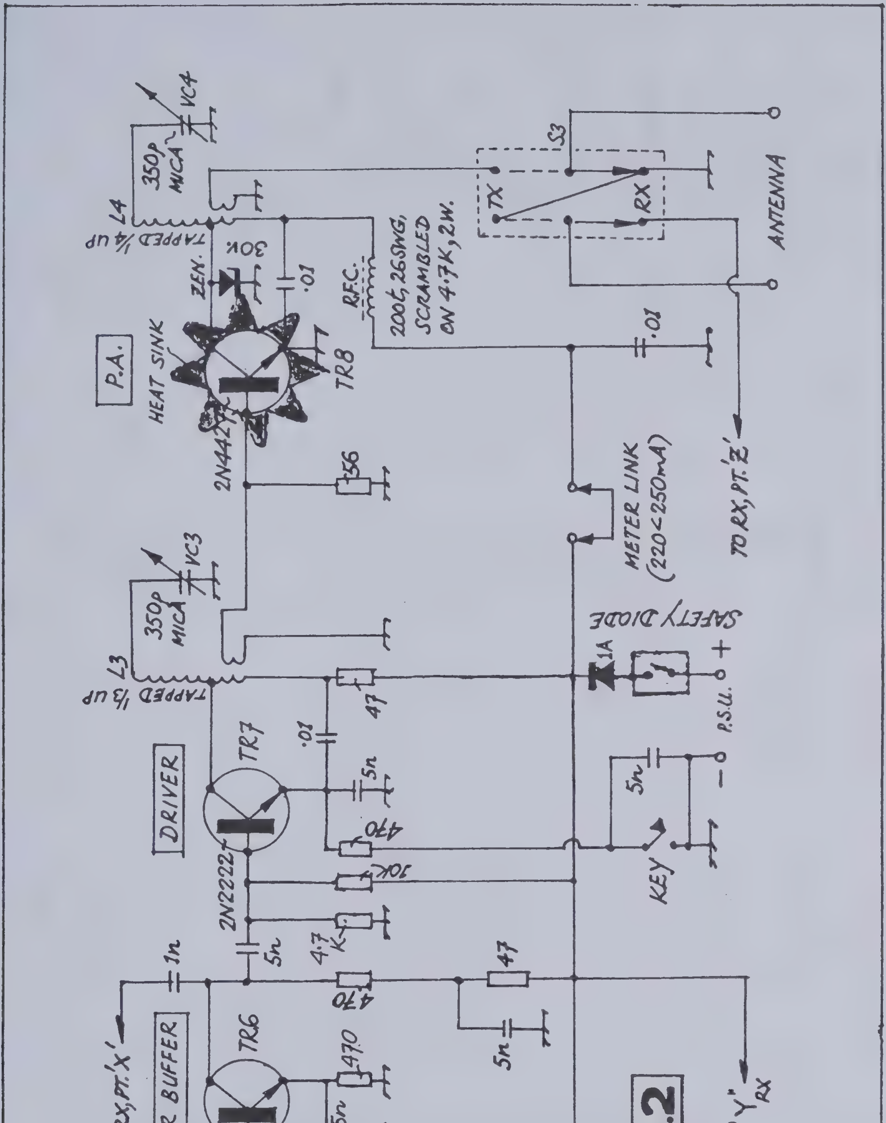
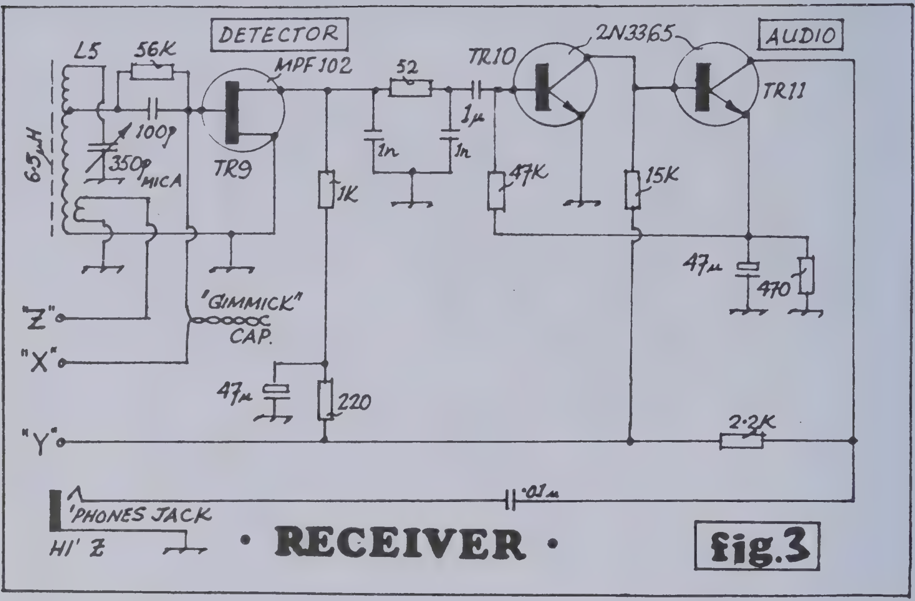

P.A.
HEAT SINK
TR8
2N4427
ZEN.
30V
.01
L4
TAPPED 1/4 UP
350p MICA
VC4
R.F.C.
200t, 26SWG, SCRAMBLED ON 4·7K, 2W.
S3
TX
RX
ANTENNA
.01
TO RX, PT. 'Z'
56
METER LINK (220<250mA)
L3
TAPPED 1/3 UP
350p MICA
VC3
SAFETY DIODE
1A
+
P.S.U.
–
DRIVER
TR7
2N2222
.01
47
5n
470
5n
KEY
10K
4·7K
5n
1n
TO RX, PT. 'X'
POWER BUFFER
TR6
2N2222
470
47
5n
470
5n
10K
4·7K
"Y" RX
X
X
SEE FIG. 1

fig.2



· RECEIVER · fig.3

G2PS TRANSCEIVER FOR 7/14/21MHz

By Arthur Parsons G2PS

Having spent several years QRT between the early 60´s and the later 70´s, I came back to an age of black boxes with my knowledge of radio construction very much outdated. However, I adapted fairly quickly to newer techniques, but became more and more frustrated at not being able to "see what was going on" so to speak, and so when a local amateur friend, G4AXO, introduced me to The G-QRP-CLUB and SPRAT Magazine, I saw right away an opportunity once more to make my own rig.

So, in spite of being a "left over" from the age of valves and being quite strange to solid state technique, I embarked upom the JU6 transceiver, which I now call my Mark 1, and which, with only one watt output, soon gave me a RST 569 report from a W2 station on 14MHz.

Before long I was well on the way with the Mark 2 rig, which I present herewith, but I would not part with the little JU6 which I can now recommend to anyone as a good starter. I hesitate to place a name of my own to this Mark 2 rig as it is made up of several excellent articles and ideas, mainly from SPRAT and the QRP Circuit Handbook, and also from Solid State Design for the Radio Amateur. These books have given me hours of pleasure and have taught me quite a lot.

For the transmitter I owe much to DJ1ZB, whose Lagos QRPeter gave me the basic idea, starting off with the VXO, but later adding a Colpitts VFO and amplifier as described in Solid State Design for the Radio Amateur, page 38. I usually drive the 2N3866 PA to 2/3 watts output, adjustable by means of the variable resistor in the 12v supply to the keyed 2N2222.

The receiver is a mixture off ideas, many of them from SPRAT and the Circuit Handbook, and here I am grateful to G3IGU (audio stages), G3IVF (audio peak filter) and to G3WWS for his article in SPRAT which gave me the idea of the three band switched RX front end which works so well. I did modify his common gate circuit to common source to try for more gain, but ran into instability prolems which I eventually cured by placing a .001 capacitor and a 10K resistor in series between the gate and drain of the MPF102 RF amplifier (not shown in my diagram).

The usual troubles with hum and audio howl, etc. were a great problem at first, and I must confess to a great deal of "cut and try" in attempts to suppress this. One great step forward was made by reducing the value of coupling capacitors between the filter and its pre-amp and between the filter and the first BC184L audio stage. These I made 0.1mfd in place of 5mfd electrolytic. The audio gain is not affected and audio instability completely cured. Hum was also dramatically reduced and finally completely cured by bonding together my separate earth of buried copper wires in the garden with the mains earth, the shack radiator and the case of the 13.8v power supply with the case of the electronic keyer with thick wire. I also found it necessary to use a relatively high value of de-coupling capacitor (220mfd) in the 12v supply to the MPF102 pre-amp to the audio filter.

I am amazed at what can be done with a simple DC receiver such as this, and when you get used to having both sidebands to cope with it feels as "hot" as many expensive black box jobs. Care in trimming the front end circuits will help in greatly reducing, or eliminating, AM inteference from broadcast staions. Scores of contacts hae been made on 40, 20 and 15 metres, including W land, and I´m hoping for more DX when conditions improve.

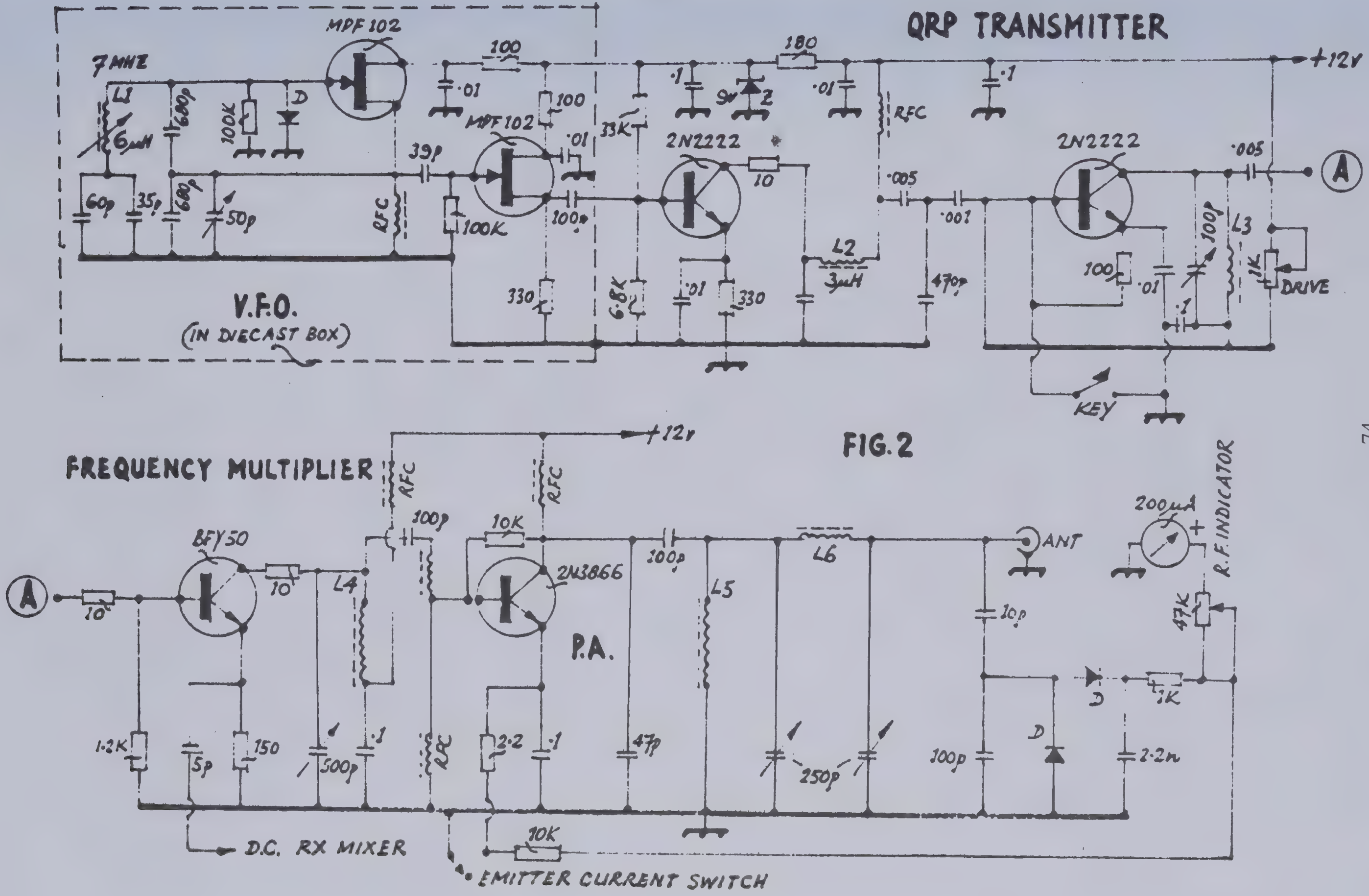
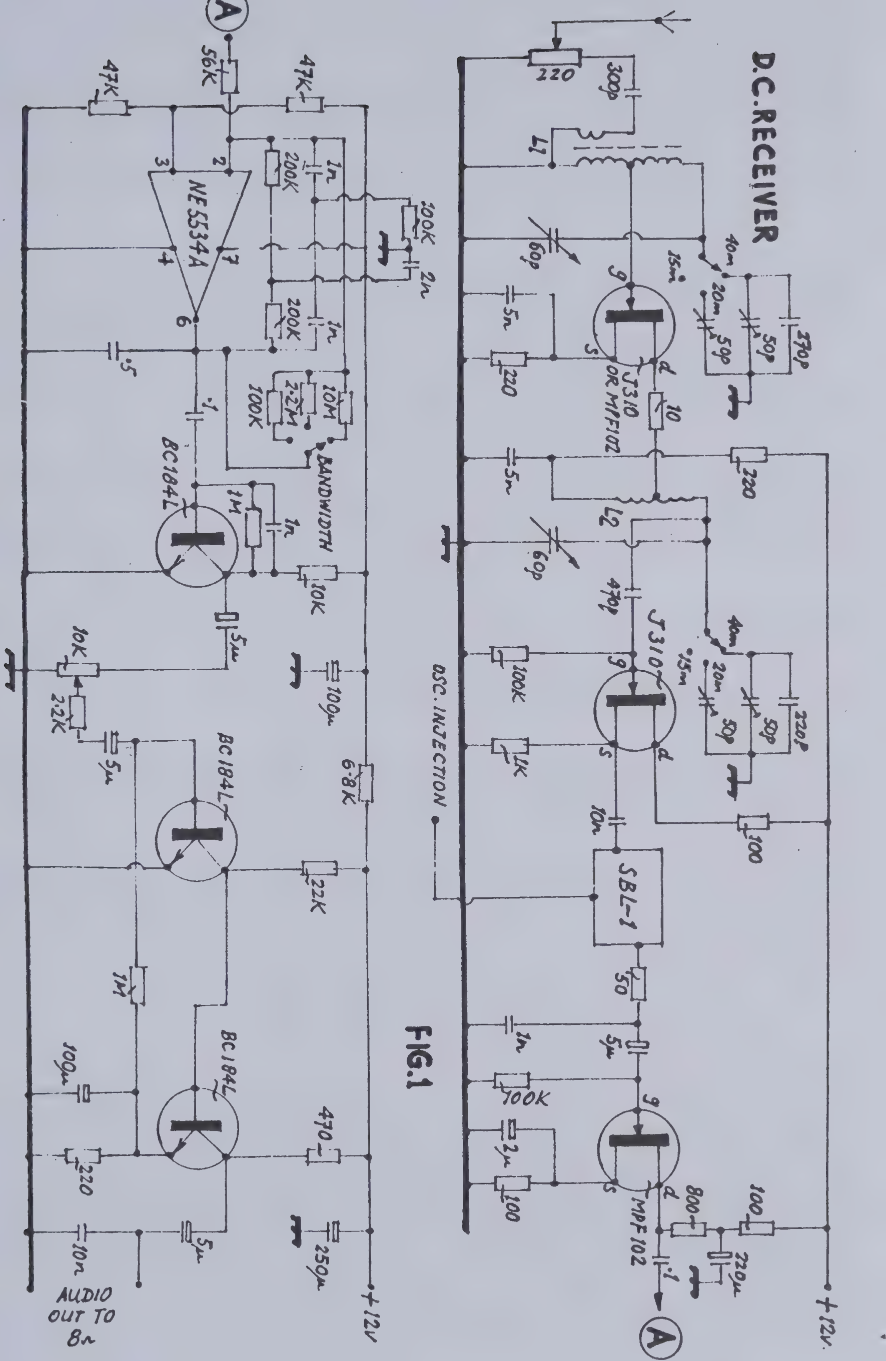

QRP TRANSMITTER
V.F.O.
(IN DIECAST BOX)
7 MHZ
L1
6µH
60p
35p
680p
680p
50p
100K
D
MPF 102
RFC
39p
100K
MPF 102
100
·01
100
·01
100p
330
33K
6·8K
2N2222
·1
9v
Z
180
10
·01
330
·01
L2
3µH
RFC
·1
·005
·001
470p
2N2222
100
·01
100p
·1
L3
1K
DRIVE
·005
A
+12v
KEY
FREQUENCY MULTIPLIER
A
10
BFY50
10
1·2K
5p
150
500p
·1
L4
RFC
100p
RFC
RFC
+12v
10K
2N3866
P.A.
2·2
·1
47p
100p
L5
L6
250p
ANT
10p
100p
D
D
·1K
2·2n
47K
200µA
+
R.F. INDICATOR
10K
D.C. RX MIXER
EMITTER CURRENT SWITCH

FIG. 2



D.C.RECEIVER

FIG.1

At present the transmitter uses plug-in coils, but I am working on a layout to use complete band-switching in the near future. Antennas used are a 40 metre Delta Loop tuned with a 600 ohm line for all bands, and a 100 feet random wire which I use mainly on 40 metres. The whole transceiver is housed in an aluminium box, size 10 x 6 x 3 inches. This rig is purely expermental and I hope it will prove of interest and encouragement to other QRP operators who may wish to make their own variations and improvements.

L1	21 turns 24SWG on T50-6 core, tap 7 turns from ground with 2 turn link
L2	Same as L1, but tap 5 turns from switch end

L1, L2	Toko miniature screened inductors (Ambit/Cirkit)
L3	30 turns 26SWG on T50-2 core
L4, L5, L6	Plug in coils for 7, 17 and 21MHz as described by DJ1ZB, page 41 of G-QRP-CLUB Circuit Handbook. I use DIN plugs and sockets, the plugs being stripped of their metal cladding. Coils wound on T50-6 cores
S1	Press to break switch to indicate PA emitter current when driver tuned to resonance (PA inoperative)

The TX/RX switching is not shown but is done with a 4 pole 3 way rotary switch which changes the antenna from TX to RX, and short the keying lead and disconnects the 12v supply from the PA on RX. The BFY50 stage must remain in operation on RX, as it acts as a buffer, doubler or tripler and therefore provides the correct oscillator injection frequency for the RX.

MAKING A SMALL PCB

By Ronnie Marshall GM4JJG

1. Get a piece of polystyrene ceiling tile and some good quality tracing paper, and collect your components.

2. Tape the paper to the tile, (which is to be smooth one). Decide where you want the components and stab the leads through the paper into the tile. They go in perfectly easily and the tile holds them firmly. Now pull them out again, inking the connecting leads on the paper as you remove the components one at a time. Then take off the paper.

3. Tape it, ink side down, on the copper surface of your board, and mark all the holes through with a sharp punch. Remove and mark in the "wiring" with a Dalo pen, just copying the layout on the tracing paper. Then drill, etch and/or engrave.

WINTER ACTIVITY POSTSCRIPT

India to UK on an OXO: 80 CQ brings back a VK3!!

Since the Winter Sports report was written further exciting news has come to hand. Firstly Andy, WB2RZU, worked across the pond to GM3OXX/A, G3VXJ, G4MQC, G4SXE and I7CCF during the Winter Sports. Secondly, on 14060 at 1502z, 28th December, GM4HBG/A (3w) began a solid QSO with VU2TTC, Madras, who was using an OXO. This has been confirmed by QSL. It is known that the OXO was sent out to VU2TTC from the UK. Which of our members sent it, please? Back at his home QTH, at 1950 on 23rd January, GM4HBG called CQ DX on 3505KHz and back came VK3NC! During the next hour and 40 minutes, HBG also worked VE1BNN and K2RR/1 on the same feequency. Well done all conerned!

SHHH... QUIET 30M ANTENNA

By Ed Lappi WD4LOO

(Reprinted from QRP ARCI Quarterly)

Ever since 30 metres was opened up for general amateur use, I have been looking for an appropriate antenna for this band. I had long ago determined that vertical antennas were out of the question for my QTH because of high voltage power lines which passed within a couple of hundred feet of the property line, and their subseuent high noise levels. I needed a horizontally polarised antenna with as much man made noise rejection as possible.

The antenna about to be described appeared in the October 1983 edition of 73 Magazine by K9AZG, and therefore I cannot claim any originality for its design. However, it is one good 30 metre antenna, is cheap to build, and as it is fed from the bottom, it is horizontally polarised.

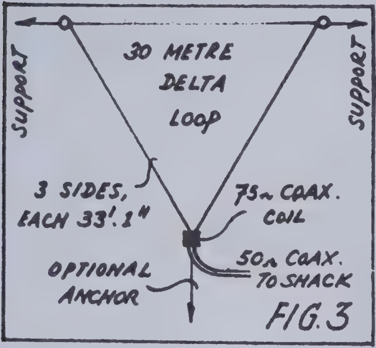


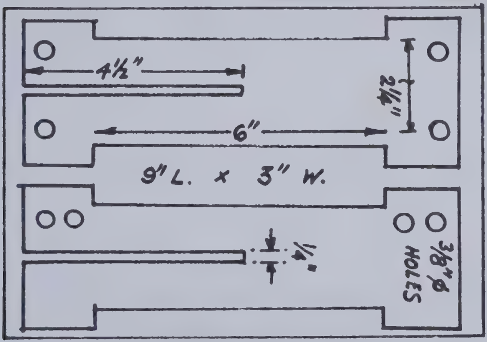
FIG.3

Essentially the antenna is a traditional delta loop, with the delta pointed towards the ground, and the flat top as high as possible between two supports or trees. The main difference in this delta loop is that at the bottom there is an impedance transforming system for balanced to unbalanced conversion so that the delta loop can be fed with coax and still retain a balanced radiation pattern and the highest possible efficiency.

The impedance transforming system consists of a quarter wave length of 75 ohm RG-59/U coaxial cable, wound onto a coil on a home made former, (see diagram), serving also as the feed point insulators and anchor for the feeder.

The construction details are as follows. The coil former can be made from masonite, waterproof plywood or plexiglass of quarter of an inch thick. If it is made from plywood or masonite it can be further weather proofed by spraying or brushing on a coat of polyurethane before assembly. Cut to the dimension shown in the diagram and assemble by sliding one half of the former onto the slot on the other half of the former to form an "X" shaped coil former. Then cut the quarter wave impedance matching transformer to length using the formula 234/f x 0.75. For my antenna this worked out to 234/10.125 x 0.75 = 17ft 4ins.

Weave one end of this RG-59/U into one top hole of the former and out again through the hole directly below. Leave about three inches sticking out for connections. Now close wind the coax onto the former keeping it tight. You will find that the coax just fits on the former with the dimensions shown, with enough left over for weaving through the bottom pair of holes.



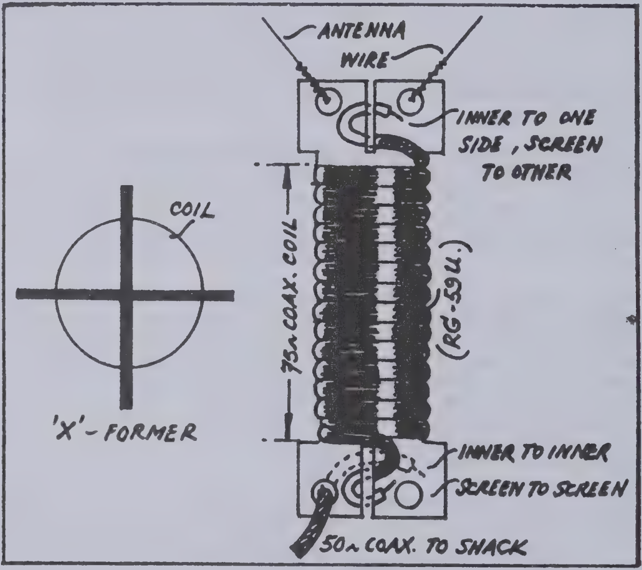
The choice of the antenna wire is left to you. K9AZG used No.14 (U.S.A.) house wire, and I used No.18 copper coated steel wire. Cut the wire to length using 1005/10.125 = 99ft 3ins. Fix two insulators onto this wire, one at 33ft lin. and the other at 66ft 2ins. These insulators allow suspending the flat top from two trees or other supports.

Finish your antenna by feeding the apex end wires of the delta loop into the corner holes at one end of the former. Twist each wire around itself to anchor it, strip back 3/4 inch of insulation and solder one wire to the centre conductor of the coax coil and the other wire to the shield.

Lastly, push one end of your 50 ohm feed line, (any legnth to reach the shack), into one of the corner holes at the bottom end of the coil former. Then through the other hole, pull it tight to anchor it leaving enough to make a connection. Solder the centre wire of the coil and shield to shield. Now tape or cover all the connections with sealer to weatherproof the antenna connections.

Like any other antenna, the higher the better rule applies to this one also, so raise your flat top as high as you possibly can. If you do not like the coil former swinging in the breeze, you may tie a small nylon cord to the coil former and the other end to a brick on the ground or to a stake driven into the ground.

Conclusions: As stated by K9AZG in his original article, this antenna has a SWR of 1:1 across the 30 metre band, and I am able to hear many stations that are lost in the noise when trying to use a vertical. For the money invested it has turned out to be an excellent antenna for this exciting band.



14MHz TRANSVERTER

By Elmar Voller DL2QA

I have been running an FT290R for VHF, but have been disappointed about the activity in SSB/CW here. Now, I would like to have a stable 20 metre rig, and found the following circuit for a transverter, which goes with my FT290R. It is not new, but designed for 20 and linear operation.

The FT290R must be operated with low power, (0.5w). The 43.5MHz oscillator is tripled to 130.5MHz and therfore 14.0-14.35 is now 144.5-144.85 on the rig.

Sure, you can use another exciter if the signal levels are nearly the same. The PA stage must draw about 20-25mA without any signal, (adjust with 1K pot). The diode 1N4148 must be soldered with the cathode side on the heatsink of 2SC1678. A heatsink for 2N3866 is also recommended. The transmiter delivers at least 3 watts on 50 ohms.

With a 12AVQ gound plane, I have made a lot of conacts, both with CW and SSB. I am always surprised about the performance of this equipment.

Coil Details

L1	12 turns 0.4mm CUL
L2	6 turns 0.4mm CUL, tapped 2 turns from the cold end
L3	25 turns 0.25mm CUL, 3 turns for the antenna
L4/L5	20 turns 0.4mm CUL, 3 turns to trnsmitter
L6/L7	11 turns 0.5mm CUL, self supporting
L8	18 turns 0.4mm CUL, 3 turns to PA - 2SC1678
L9	18 turns 0.4mm CUL, tapped 3 turns from the cole end

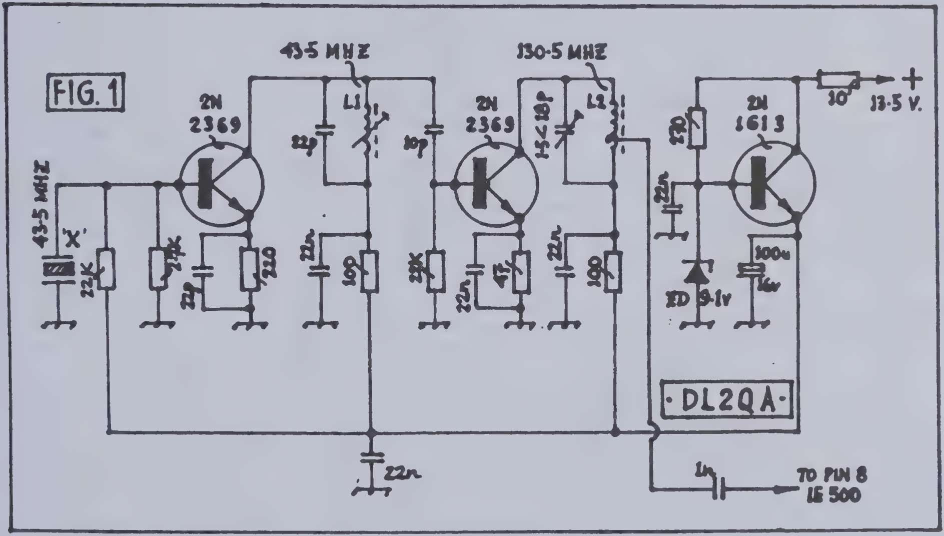
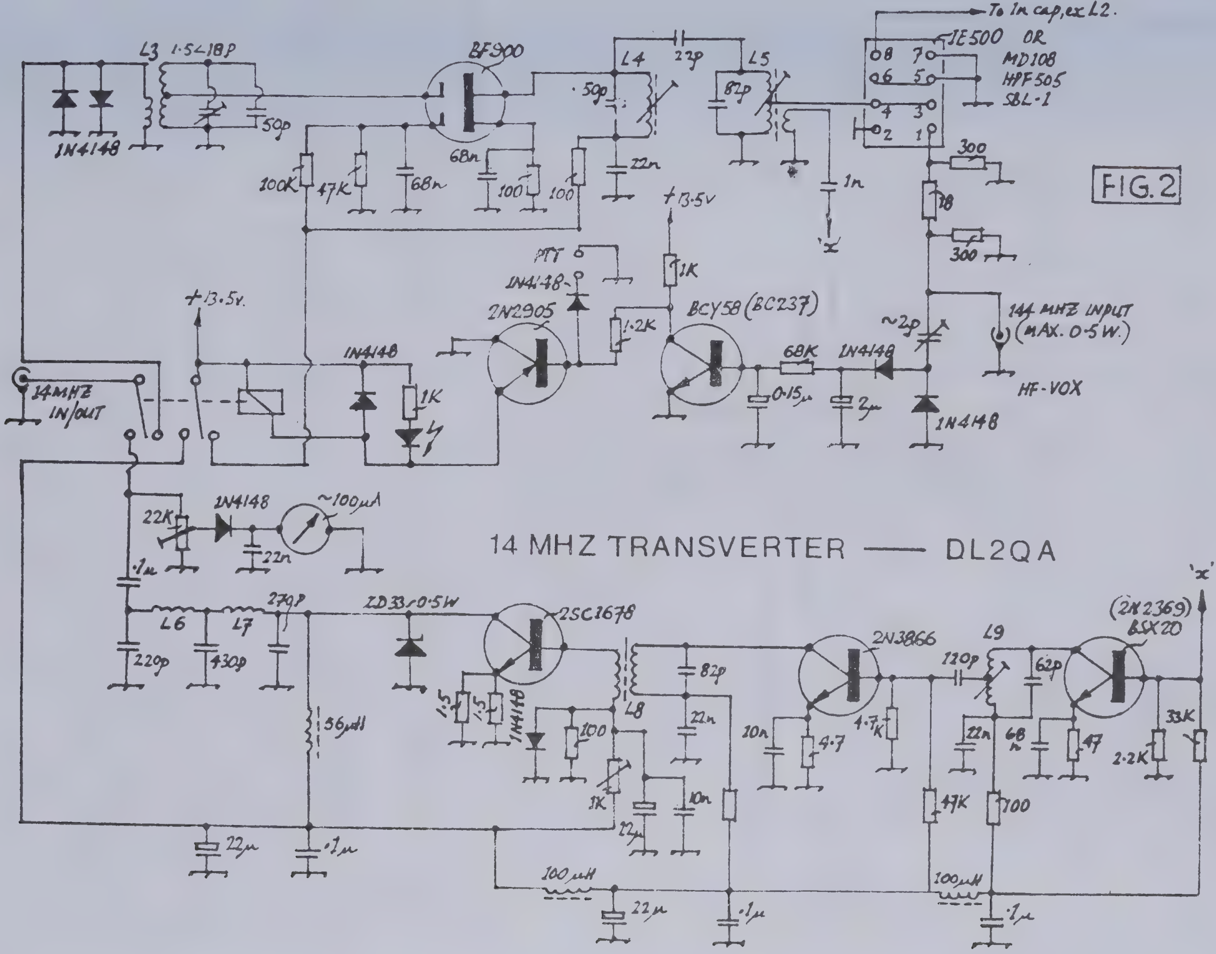


FIG. 1

TRY THE INTERNATIONAL CW QRP CALLING FREQUENCIES: 2560, 7030, 101060
14060, 21060, 28060 KHz ALL ± QRM



14 MHZ TRANSVERTER —— DL2QA

FIG.2

"TENOR" 80M DC RECEIVER

By Phil Hobson G4HOJ

The front end is a diode mixer as you can see, and it is the simplest front end which gives good results. Other mixers could be used of course, to suit the builder. Low pass and matching are achieved with R1 and C4. Two direct coupled standard configuration transistors follow with more shaping from C9. A simple buffer stage follows (more shaping from C14), and into AF gain. The final section comprises a Darlington pair with built in active low pass filtering to give reasonable output into the very cheap, lightweight low impedance phones. I wire a stereo socket so the elements are in series, giving 32 or 16 ohms, depending on the type. Under good operating conditions a 35 or 80 ohm speaker can also be connected for quiet room listening.

The AGC system takes off from the top end of the AF gain control, and amplifies into TR6. The amplified AF is passed through a delay element, R9, and then to a rectification circuit. C7 charges to an average level and this DC level is passed through a time constant resistor, R4, (this can be altered, longer delay for larger value), to the base of another transistor which acts as an AC current robbing circuit from the first two stages through C8.

The output is affected for signals well off tune if C13 is omitted, and the value given for this capacitor gives a good compromise between AGC sensitivity and AGC bandwidth. The signal path continues from the AF gain control into a Darlington pair with active filtering. The values given give a good SSB bandwidth for general purpose use, but bandwidth can be reduced for CW only by increasing the marked resistors to 3.3K. If these resistors are changed C13 can be increased to 10n, R1 to 5.6K and C9 to 10n to sharpen up the response further.

A DC amplifier is coupled to the AGC line and as shown drives a 500uA meter with very useful scale proportion. R3 sets full scale and R21/22 ratio sets zero. Alter these resistors for different meters.

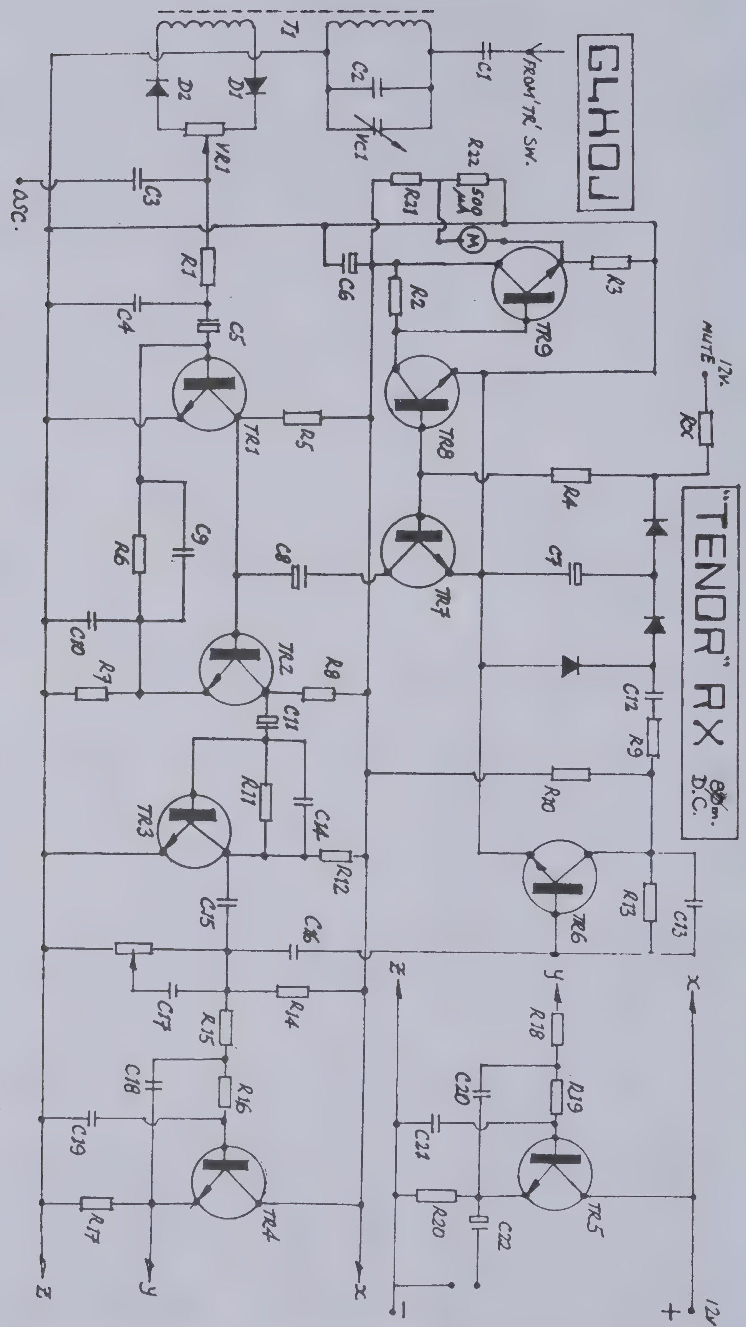
Finally, I did not know what to call it, everybody seems to have a name for their creations nowadays. I totalled up the cost of all the components, (new and from a single source), and it came to £9.99, although I used salvaged bits etc. So I thought of the "Tenner" or "Tenor". Other than that it is just the HOJ 80m RX. Other bands are available, I did try it with a multiband transmitter and no padding capacitor, and using the salvaged polycon, both sections, the front end would tune 80, 40, 30 and 20 (just!). I've used the receiver birds nested, then on a board, with various transmitter oscillators coupled in, and the results have been most encouraging. I've designed a board which can either be one piece or four modular sections which is 11 x 4 cms. I have not included this as I know most people have their own special building ways. The circuit draws around 15mA from a 12v dryfit rechargeable cell. No problems with this low impedance supply, maybe more line decoupling if higher imepedance supplies are used.

Anyway, that's it. I like it. After the Oner, the "Tenor" represents some inflation doesn't it? I am thinking about a transceiver based on this for the construction contest, but maybe this will be accepted.

DX and RX can be omitted if muting is not required, (1N914, 100K)
TR8, TR9, R2, R3, R21 and R22 can be omitted if meter display not required

R1	3.3K	R2	100K	R3	4.7K	R4	10K	R5	39K	R6	1.2M
R7	470	R8	2.2K	R9	2.2K	R10	12K	R11	1.2M	R12	12K
R13	680K	R14	150K	R15	1.5K*	R16	1.5K*	R17	2.2K	R18	1.5K*
R19	1.5K*	R20	2.2K	R21	4.7K	R22	47K	C1	47pF	C2	180pF
C3	1n	C4	0.1uF	C5	1uF	C6	470uF 16v	C7	40uF 10v		
C8	47uF 10v	C9	4n7	C10	22uF 6.3v	C11	1uF 50v	C12	0.47uF	C13	4n7
C14	1n	C15	0.47uF	C16	0.47uF	C17	0.47uF	C18	0.1uF	C19	0.022uF
C20	0.1uF	C21	0.1uF	C21	0.022uF	C22	10uF 16v	VC1	300pF polycon		

T1 T50-2 prim. 30t, sec. 3t bifiliar
D1-D4 1N914 VR1 1K preset VR2 100K log Transistors all BC183 Meter 500uA


GL4ODJ
"TENOR" RX
D.C. 80m.
FROM 'TR' SW.
C1
C2
VC1
T1
D1
D2
VR1
C3
OSC.
R1
C4
C5
TR1
R5
R6
C9
C10
R7
TR2
R8
C11
R11
C14
TR3
R12
C15
C16
C17
R14
R15
R16
C18
C19
R17
TR4
R22
500 µA
M
R21
C6
R2
R3
TR9
12V.
MUTE
RX
TR8
R4
TR7
C8
C7
C12
R9
R10
TR6
R13
C13
R18
R19
C20
C21
R20
C22
TR5
x
y
z
12V
+
-

THE QSK-1 - A ONE TRANSISTOR CW TRANSCEIVER

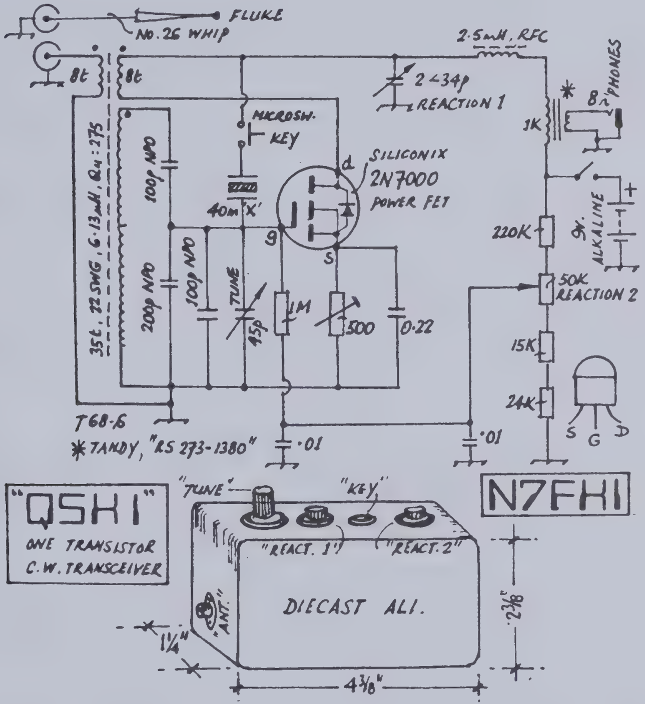
By Bob Culter N7FKI

This project is in now way practical! It was done to see what could be done with a single semi conductor. It was a lot of fun!

The Siliconix 2N7000 is a TO-92 power FET and has the following specification: 60v, 400mW, Id max = 0.2A, Vgs(th) = 0.8-3v (Id = 1mA), gfs = 100mS (Id = 2oomA, Vds = 10v), Ciss = 60pF.

It is possible to set up the QSK-1 to super-regenerate and although this gives it sidetone capability it also transmits on more than one frequency, (very undesirable). Needed improvements are more power by keying a higher bias on the gate and also reflex regenerative.

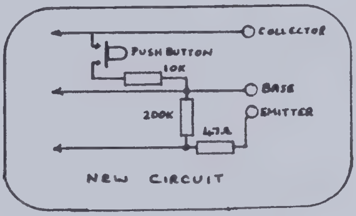
The first QSO with the transceiver was on 22.2.86 at 0800 on 7113MHz with my XYL Terry, KA7VAF, whilst I was walking around the neighbourhood! RST was "very clear" both ways. The QSK-1 is really QSK, I heard Terry break in.



CORRECTION TO "ROCK'S TEST BOX"

SPRAT 48.

The transistor tester section resistors should be as shown here.



CONSTRUCTION COMPETITION

50MHz DIRECT CONVERSION TRANSCEIVER

By Bob Carter G4VSO

Construction Notes
Having aquired a surplus 50.197MHz crystal, the idea of a rig monitoring the calling channel became very attractive. With this in mind I decided to have a go at a 6m rig. I hope that the following notes are of help.

Board 1
Audio amplifier board (TR7 and TR8), built on .1 veroboard, 30mm x 50mm. Classic design out of "Solid State Design", no problems with construction, liberal use of tantalum capacitors helps keep the size down.

Board 2
Mixer and audio preamp (SBL1 TR6), built on .1 inch prototyping board, similar to that shown in "Solid State Design". This type of mixer was used because one was available, and an increasing number of designs were using them. Lead lengths were kept very short and plenty of decoupling was used. Extra decoupling in the form of R21 and C31 was added to prevent microphony, in the form of noise picked up when the case was touched. A high pass filter was fitted to help with medium wave break-through, the filter has a cut-off frequency of approximately 35MHz. This also helped to reduce the microphony.

Board 3
Oscillator and buffer (TR1, TR2 and TR3), built on prototyping board 70mm x 30mm. The oscillator is similar to that out of the "VHF and UHF Manual", Edition 1, page 8.10. A VXO swing of approximately 10KHz was obtained, a switch was added to enable the crystal to be pulled up to 50.2MHz, but with much reduced frequency shift (this option could be omitted if required). More stable oscillation over the VXO swing was obtained at lower voltages, so a zener diode was added. TR3 is a simple class A buffer with approximately 20mw output. Transformer T1 splits the power between the PA and the mixer, 3dB attenuator is fitted in the local oscillator input to reduce the level to 7dBm.

Board 4
PA built on a prototyping board 40mm x 30mm, very simple circuit using 2N3866 transistor. No real attempt was made to match the output to 50R, R10 was adjusted to give a quiescent current of 50ma, so that the stage is running in class AB, 0.7 of a watt output was obtained (after low pass filter). Further power out could be obtained if a further matching circuit was added (L and 2 Cs).

In the original version only the PA was keyed, but it was soon found that the rig was radiating 15mw with the key up. In fact a report of S7 was obtained from approximately 15 miles away. A simple modification to the key both the buffer and the PA removed the problem.

Board 5
50MHz low pass filter built on double sided P.C board, appoximately 50mm x 30mm x 30mm, to form a completely screened box. Interstage screen was also fitted. Use of an FM receiver proved very useful to check the second harmonic, L5 and L6 were adjusted to give the best rejection of the second harmonic.

Board 6
Sidetone oscillator (TR9 and TR10), built on .1 inch veroboard 20mm x 15mm. TR9 and TR10 could be replaced by a simple unijunction transistor. Normal design values for R34 and R35 were 3.3K and 1K, but in my version the circuit would nt work until R34 was reduced to 1K. In fact I had more problems with this circuit than with any of the other boards.

Tests
Both harmonic and sensitivity tests were carried out on the completed equipment, checking second and third harmonics on a spectrum analyser, both were found to be 50dB down on the main carrier. A signal of 1uv could easily be heard in the headphones.

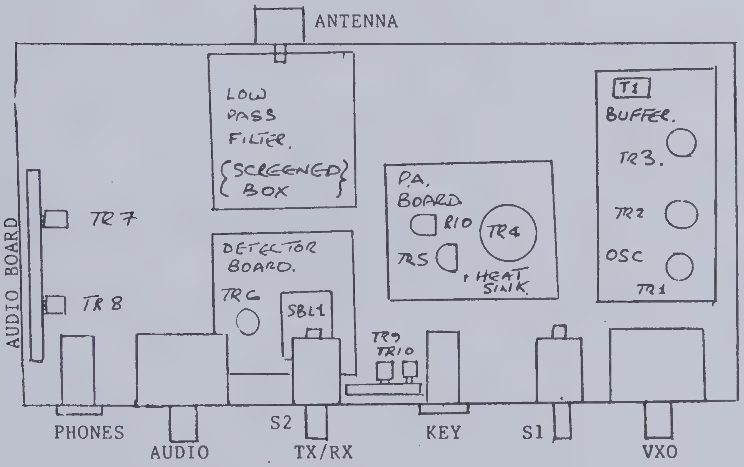
Use
The rig has been in use for the last four months and several contacts have been had in the Reading area. The antenna is a dipole in the loft, 30 feet high.

References

1. "Solid State Design", ARRL.
2. "VHF UHF Manual", RSGB.
3. "Radcom", January 1986, 'Direct Conversion Tranceivers'.

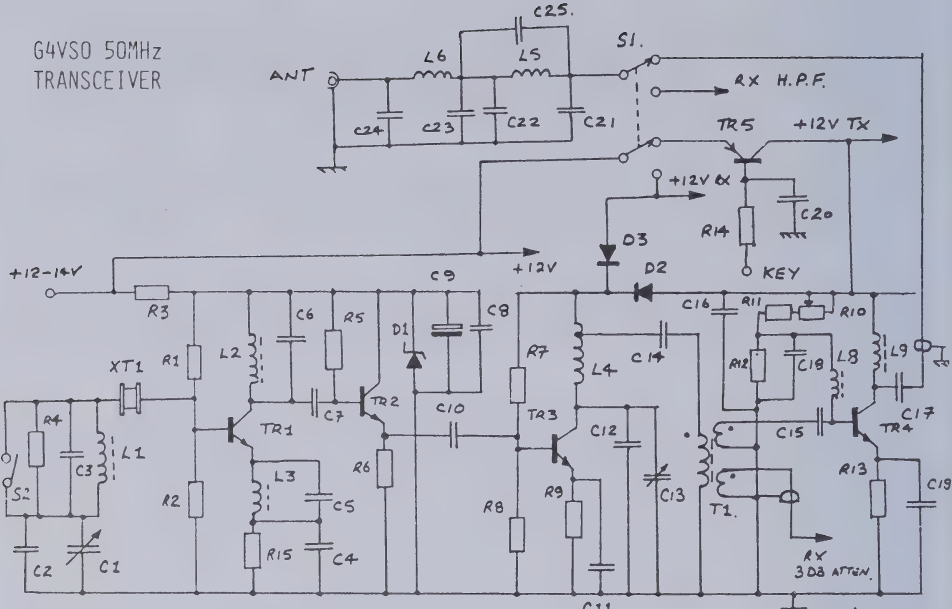
Improvements
1. Add a VFO with a control loop similar to that published in SPRAT, issue 48.
2. Add a Jfet preamp to improve sensitivity.

Alternative Components
Electrolytic capacitors could be substituted for tantalum capacitors to reduce the cost of the rig, but this would increase the size of the unit.

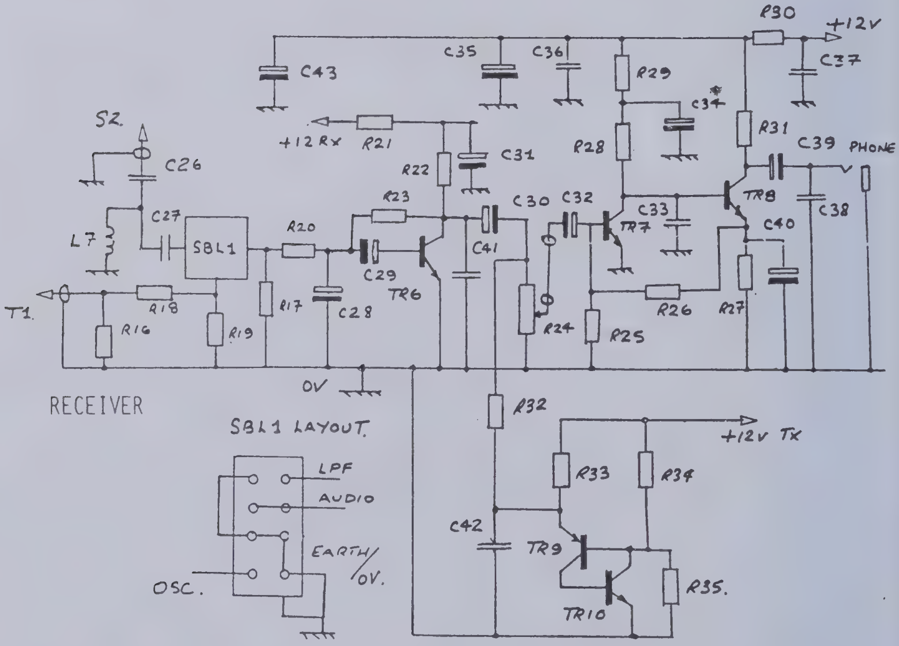


INTERNAL LAYOUT OF TRANSCEIVER

G4VSO 50MHz TRANSCEIVER



TRANSMITTER



RECEIVER

SBL1 LAYOUT.

COMPONENT LIST

R1	33K	1/4W	5%
R2	10K	1/4W	5%
R3	220R	1/4W	5%
R4	4.7K	1/4W	5%
R5	150K	1/4W	5%
R6	1K	1/4W	5%
R7	10K	1/4W	5%
R8	1.5K	1/4W	5%
R9	100R	1/4W	5%
R10	2.2K	Preset	
R11	560R	1/4W	5%
R12	56R	1/4W	5%
R13	3.3R	1/4W	5%
R14	1K	1/4W	5%
R15	1K	1/4W	5%
R16	270R	1/4W	5%
R17	68R	1/4W	5%
R18	18R	1/4W	5%
R19	270	1/4W	5%
R20	220R	1/4W	5%
R21	1.2K	1/4W	5%
R22	4.7K	1/4W	5%
R23	1M	1/4W	5%
R24	10K	POT LIN	
R25	10K	1/4W	5%
R26	47K	1/4W	5%
R27	2.2K	1/4W	5%
R28	4.7K	1/4W	5%
R29	1K	1/4W	5%
R30	15R	1/2W	10%
R31	2.2K	1/4W	5%
R32	4.7M	1/4W	5%
R33	100K	1/4W	5%
R34	1K	1/4W	5%
R35	1K	1/4W	5%

C1	50pF	air spaced variable
C2	2.9pF	Ceramic
C3	15pF	Ceramic
C4	1n	Ceramic
C5	47pF	Ceramic
C6	15pF	Ceramic
C7	3.9pF	Ceramic
C8	.1uF	Ceramic
C10	10uF	Tant 25V
C11	1n	Ceramic
C12	22pF	Ceramic
C13	22pF	plastic variable
C14	120pF	Ceramic
C15	220pF	Ceramic
C16	.1uF	Ceramic
C17	10n	Ceramic
C18	1n	Ceramic
C19	1n	Ceramic
C20	.1uF	Ceramic
C21	56pF	Poly 2.5%
C22	56pF	Poly 2.5%
C23	56pF	Poly 2.5%
C24	56pF	Poly 2.5%
C25	22pF	Poly 2.5%
C26	82pF	Ceramic
C27	82pF	Ceramic
C28	1uF	Tant 25V
C29	10uF	Tant 25V
C30	10uF	Tant 25V
C31	10uF	Tant 25V
C32	2.2uF	Tant 25V
C33	.1uF	Ceramic
C34	10uF	Tant 25V
C35	47uF	Tant 25V
C36	.1uF	Ceramic
C37	1n	Ceramic
C38	1n	Ceramic
C39	2.2uF	Tant 25V
C40	10uF	Tant 25V
C41	1n	Ceramic
C42	.022uF	Poly 2.5%
C43	470uF	Electrolytic 16V

L1 9 Turns on 4mm former slug tuned
L2 12 Turns on 4mm former slug tuned
L3 12 Turns on 4mm former slug tuned
L4 4 Turns on 4mm former slug tuned
L5 .11μH 5 turns on T50/6 toroid
L6 .11μH 5 turns on T50/6 toroid
L7 .22μH axial inductor
L8 4 turns on ferrite bead FX1115
L9 3 turns on ferrite bead FX1115

T1 Primary 3 turns, secondary 2+2 on twin ferrite bead A0004X030 (electrovalue)

D1 10V 330mV zenner diode
D2 IN914 Switching diode
D3 IN914 Switching diode

TR1 BSX 20
TR2 BF115
TR3 BSX20
TR4 2N3866
TR5 ZTX313(any PNP)
TR6 BC109
TR7 BC109
TR8 BC109
TR9 ZTX313(any PNP)
TR10 ZTX212(any PNP)

Mixer SBL1
XT1 50.2MHz 3rd overtone xtal HC25U

HARDWARE
S1 DPDT TX/RX
S2 SPDT VXO swing
1/4 inch key socket
1/4 inch phone socket
Ant socket
Misc nuts and bolts
Diecast box 170mm X 120mm
.1 veroboard, copper clad board and prototype board
TO5 heatsink

THE QRP 80 - A 3.5MHz 2.5 watts CW TX

The circuit is not entirely originql. The driver is based on Peter Brent's JU6 mod. with a change of transistor. The VFO used is as shown on page 18 of the G-QRP-Club Circuit Handbook, but I had to play around with the tuned circuit to cover 3.5 - 3.6MHz.

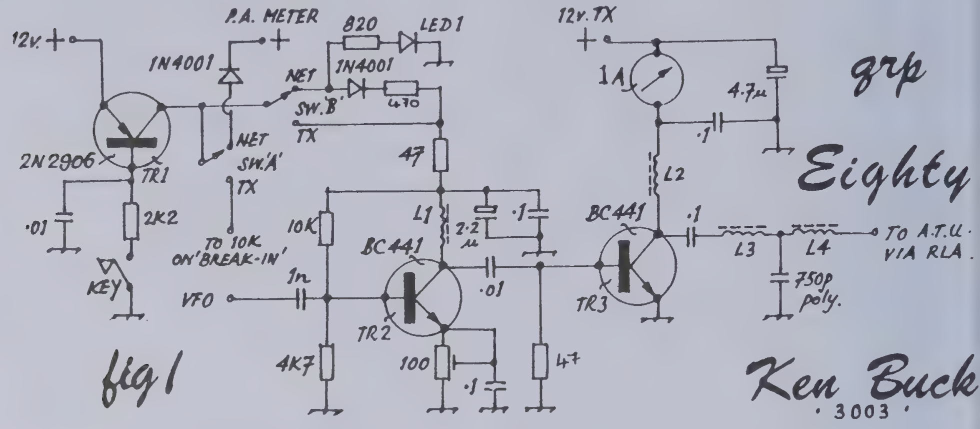


fig 1

L1 53t 36 SWG on 1W carbon resistor
L2 10t 24 SWG on 7mm ferrite ring, (rally surplus)
L3 16t 24 SWG on T50-2
L4 23t 24 SWG on T50-2
All resistors, including the presets, are 0.5 watt carbon.
Fixed resistors are 5% tolerance
SW A/B is a SPDT toggle
LED 1 is Maplin Catalogue part no. QY96E
100 ohm driver preset is Maplin part no. WR38R

CONSTRUCTION COMPETITION

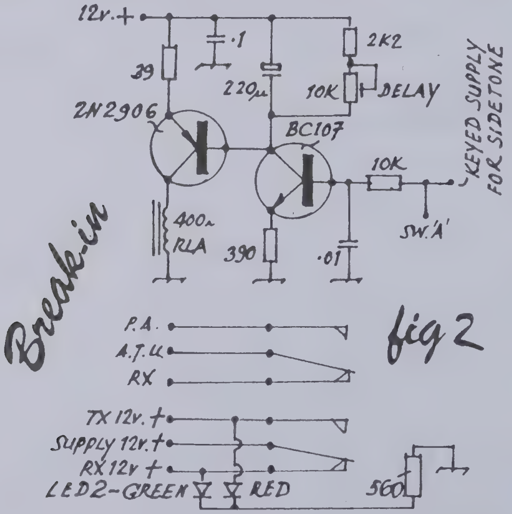


fig 2

The 220mF capacitor on break-in will hold in the relay for most keying speeds but can be increased to 330mF. Change-over is swift with no relay clatter.

Extensive use of screened leads reduced unwanted radiation on receive. The driver collector choke L1 is wound on a 1K 1W carbon resistor, the older 10% type is best for this. A heatsink is not required as the transistor runs cold on 2.5 watts PA input. The preset can be replaced with fixed resistors to reduce the drive level as a front panel control. Before testing the transmitter, this preset should be set to 82 ohms and then re-adjusted after switch on. The net switch can be a 3 pole 2 way to short the key on "NET", but the contacts must be break before make. The 390 ohm resistor gives just sufficient drive to switch on the PA for a net signal, but can be adjusted. A BC441 is used for the PA and is rated at 2 watts. It must be fitted with a finned clip on heatsink and will run quite happily at 2.5 watts in Class C. The experienced builder can increase the input to 3 watts, but avoid long periods of key down and don´t attempt to increase the heatsink area to squeeze out more power. The easiest way to destroy a PA transistor is to overdrive or run it into a poor mismatch.

If you are a newcomer to QRP construction, it would be wise to use a 50 ohm resistive bridge as the output is always correctly loaded, (see page 63 of G-QRP-Club Circuit Handbook, or G3RJV´s PW DART TX). Sufficient drive is available for a parallel 4 watt PA stage involving a few component changes. With care, this stage is capable of a lot more than 4 watts, but beginners should keep to the 4 watts.

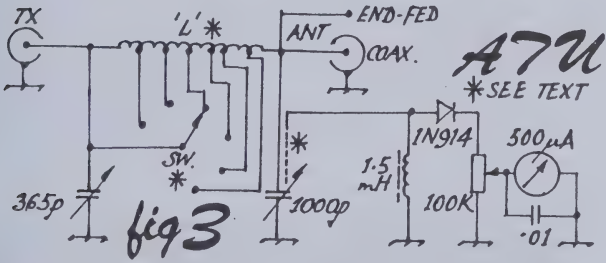


fig3

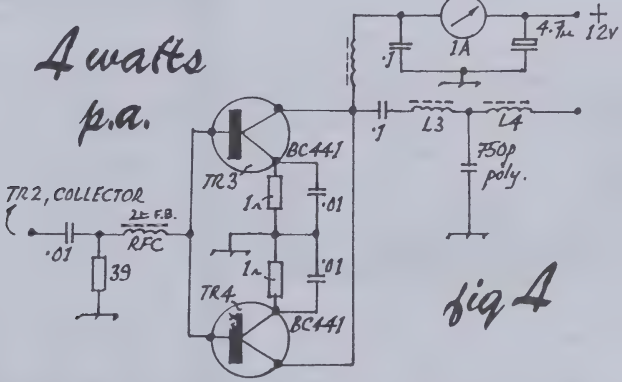
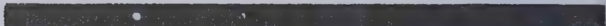


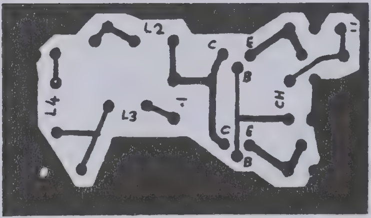
fig 4

A sidetone circuit is not given as there are plenty in the magazines. The one on page 17 of the G-QRP-Club Circuit Handbook will fit on the PCB near the driver transistor. The only difference is the +12v supply, and this should be taken from the keying transistor and not the PA. The pi-network inductor has 30 spaced turns on a 1.25 inch diameter former. Bifilar wind the 18 SWG tinned copper wire with 16 SWG on a coat of varnish, then remove the unwanted winding when the varnish is almost dry. Mask off a narrow strip across the coil length for the tapping points and re-varnish. The ATU will load short wire lengths and is ideal for restricted space antennas.

QRP 80 FOIL PATTERN

(FOIL SIDE)





QRP ·80 4W PA (FOIL SIDE)

THE VFG SIDEKICK

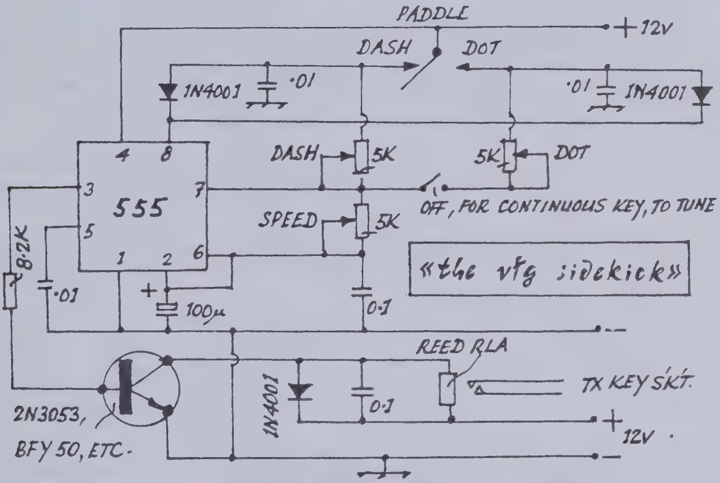
By G4VFG

This is a simple 'side swipe' type keyer suitable up to about 25 WPM or so. It has three controls, one for speed and the other two the mark/space ratio; the dot and dash function of the latter can be transposed by altering the settings.

Reference was made to Radcom, Tech Topics October 1979, although that circuit did'nt actualy work.

The circuit is straight forward. The reed relay is RS or similar. I fitted the 555 and the BFY in holders to aid maintenance. The original was constructed on Veroboard and mounted on spacers horizontally above the key itself. This key is a Himound double paddle which, although not cheap, is a good investment and should last a lifetime. I do no prescribe to the nailfile and bent wire brigade.

The whole thing is mounted in a metal box. A screened lead was used to connect it to the rig - in this case an FT77. No sidetone was incorperated because it was not needed. Power was taken from the shack 12V CBtype PSU



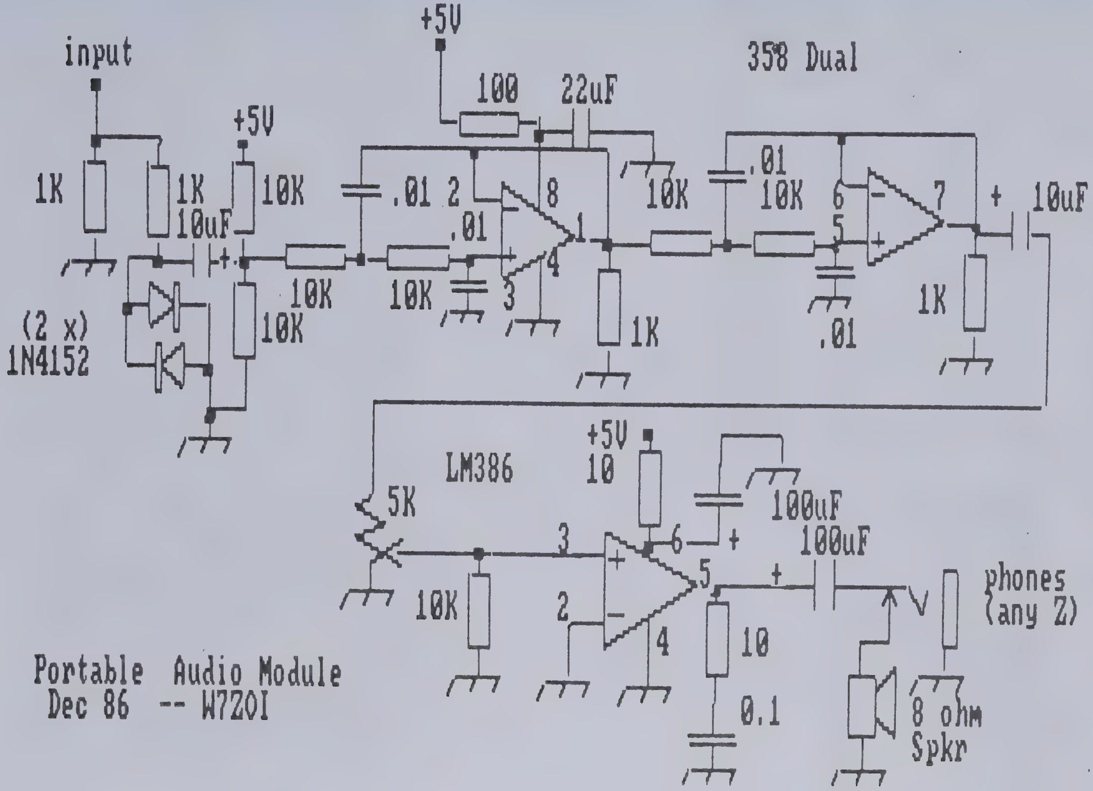
AN OUTBOARD AUDIO MODULE FOR SIMPLE RECEIVERS

By Wes Hayward, W7ZOI

Most of the little receivers that we all build are used with our favourite set of headphones. We all have them However, there is occasional need to drive a speaker, perhaps to demonstrate something to another club member.

Direct conversion receivers could sometimes use some gain limiting, a replacement for a more complete AGC. In other instances, we need a bit more audio gain, or some selectivity, or a quick tail end for the next receiver of the month.

The attached circuit serves these functions at W7ZOI/W7. The circuit begins with a pair of back-to-back silicon diodes. These operate as a clipper, limiting the peak signal amplitude. Odd order harmonics will be created by the clipping. These are, however, largely removed by the four pole RC active low pass filter that follows the clipper. The filter uses a small, dual op-amp. The filter then drives an output amplifier using the ever popular LM386. The resulting audio excites either an internal speaker, or external headphones. The circuit operates from 5 volts, supplied by four NiCad batteries. The no-signal current is 12mA. The entire circuit, with batteries and speaker, resides in a 1x3x6 inch box. Not shown in the schematic is the off-on switch, a switch for the clipper, and circuitry for NiCad charging. A mylar cone speaker was chosen, for it is more tolerant of moisture.



Portable Audio Module
Dec 86 -- W7ZOI

The G3XBM 'Pipit' 21MHz Transceiver

Specification

Frequency Band	21MHz
RX Sensitivity	<0.5uV for 10dB S/N
TX Power Output	approx 0.8W
VXO Range	2 x 15kHz
Break-in	Instantaneous electronic (listen between dots).

Circuit Description

The circuit is loosely based on the OXO transmitter with an SBL1 based DC receiver. It has a full QSK keying system without relays or TX/RX switches being necessary. Only one component, the RX input tuned circuit, needs alignment.

The only gain control is the RF attenuator on the RX input. This is the best place since, whenever possible, it allows the receiver to be de-sensitised giving added protection from overload and breakthrough. In practice, most contacts with QRO stations occur with around 10-20dB input attenuation in line.

PIN diodes were used in the antenna change-over circuit because these were at hand. They could probably be replaced by 1N4148 diodes with only slightly degraded performance.

The toroids used were Neosid rather than the more common Cirkit ones, again because these were at hand but other types could be substituted, maybe with minor turns adjustment.

There is a slight frequency offset between TX and RX as the oscillator loading alters when the TX PA is keyed, the amount of shift being just about optimum for CW! Increasing the turns on L8 will allow further frequency shift with the VXO but the difference between RX and TX frequency can then become too great to be usable.

The TIS43 provides sidetone with R9 and C14 helping to make the note more agreeable to the ear. M1 and TR1 could probably be replaced by a MOSFET mixer with some conversion gain, but this hasn't been tried.

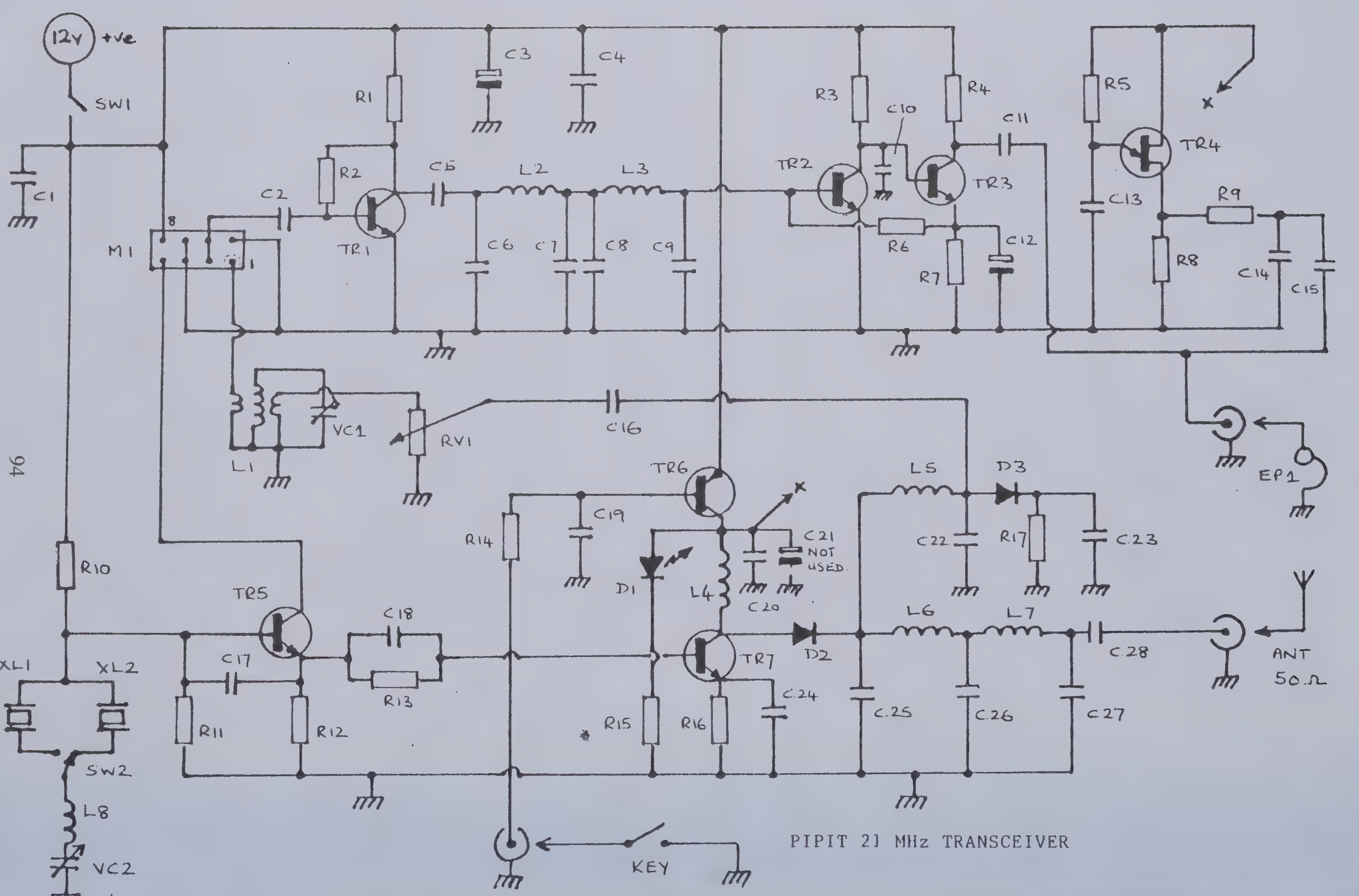
The whole rig is built into a 4" x 4" x 2" metal box using 'ugly' construction on a 3" x 2" copper laminate board for most of the components.

The rig has been in use for about two years and has allowed contacts with 6 USA states and all over Europe using just a wire dipole at a maximum height of 25'. With improving HF conditions 21MHz will be an excellent band over the next few years. The Pipit is easily adaptable to other bands up to 28MHz.

Isn't HF QRP just wonderful!

Roger Lapthorn
G3XBM

L1	20t primary, 1t output, 1t input on 0.25" diam. Neosid 'pink' toroid.
L2,3	82mH TOKO inductor, part number 181LY-823 (Ambit)
L4	20t on 0.25" diam. Neosid 'turquoise' toroid.
L5	4t on 0.25" diam. Neosid 'turquoise' toroid.
L6,7	3t on 0.25" diam. Neosid 'turquoise' toroid.
L8	8t on 0.25" diam. Neosid 'pink' toroid.



PIPIT 21 MHz TRANSCEIVER

Component List - Pipit

R1	6.8k
R2	470k
R3,10	10k
R4	1.2k
R5	100k
R6,9	47k
R7,12,17	470
R8	5.6k
R11	4.7k
R13,14,15	1k
R16	15 (10-39 select on test for 0.8W RF)

TR1,2,3,5	ZTX108, BC108 etc. NPN
TR4	TIS43 or similar
TR6	ZTX212,213 etc. PNP
TR7	2N4427, 2N3866 etc.
D1	LED (red).
D2,3	PIN diode e.g. UM9401 (see text).

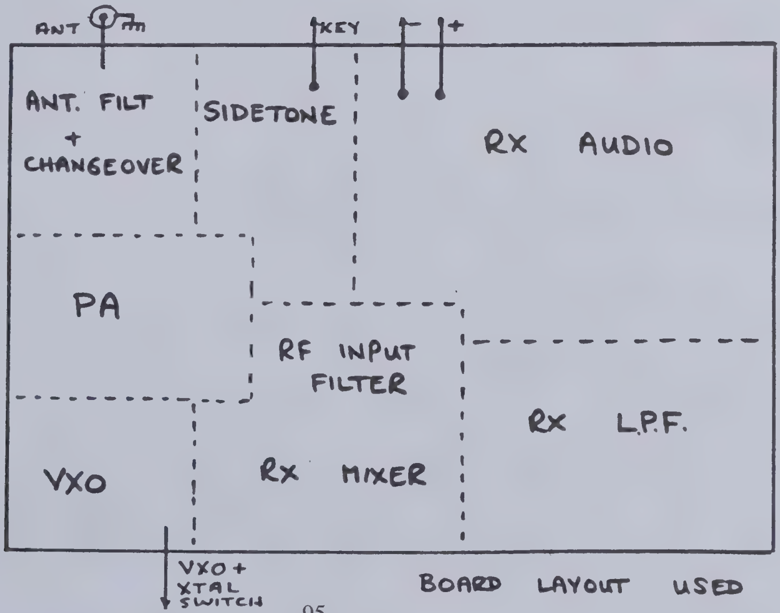
RV1	1k lin.

M1	SBL1 Double Balanced Mixer

C1,2,5,11, 15,16,19, 20,24	0.1uF
C3	47uF
C4	1n
C6,7,8,9	0.47uF
C10,23,28	2.2n
C12	6.8uF
C13	0.068uF
C14	4.7n
C17	100p
C18	27p
C21	-
C22	150p
C25,27	180p
C26	270p

XL1	21.050 MHz fundamental
XL2	21.060 MHz fundamental
VC1	60p variable
EP1	High Impedance Earpiece
SW1	On-off switch
SW2	Single pole - two way

Enclosure 4" x 4" x 2" metal



BOARD LAYOUT USED

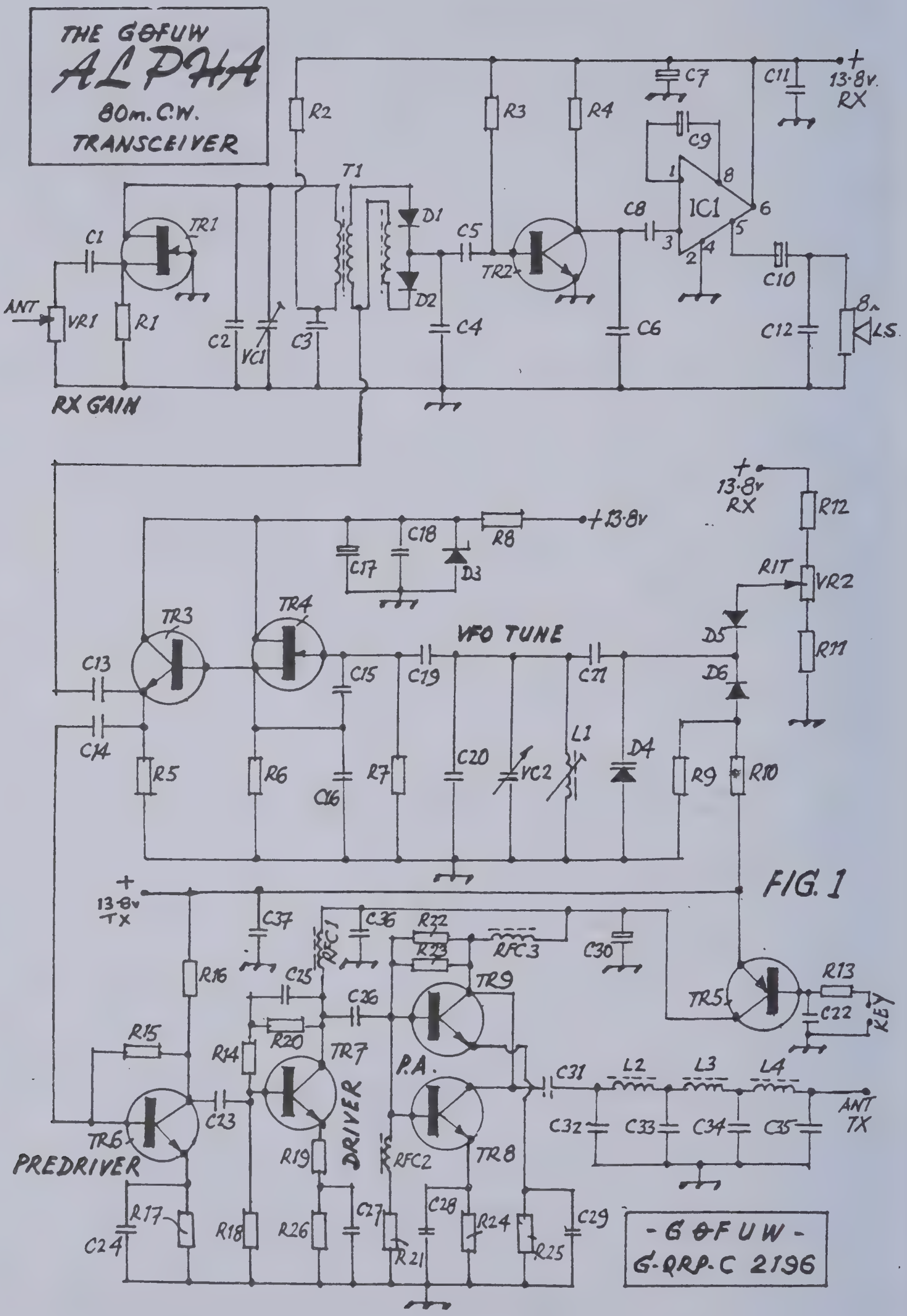
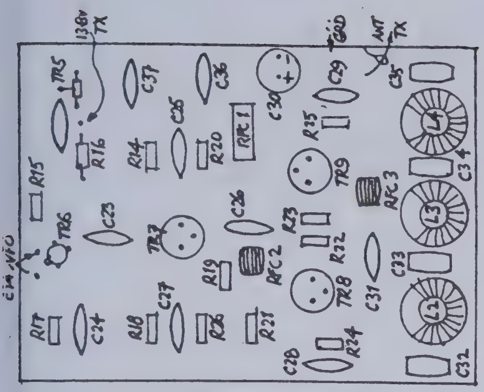
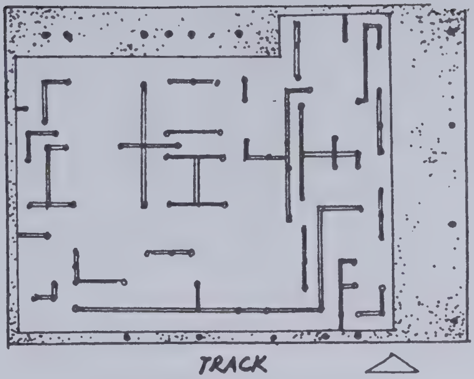

THE G0FUW
ALPHA
80m. C.W.
TRANSCEIVER
R2
R3
R4
C7
C11
+
13·8v.
RX
C9
1
8
IC1
6
5
C8
3
2
4
T1
D1
D2
C5
TR2
TR1
C1
ANT
VR1
R1
C2
VC1
C3
C4
C6
C10
C12
8Ω
LS.
RX GAIN
+
13·8v
RX
R12
RIT
VR2
D5
D6
R11
C18
R8
+13·8v
C17
D3
TR3
TR4
VFO TUNE
C13
C15
C19
C21
C14
R5
R6
C16
R7
C20
VC2
L1
D4
R9
R10
+
13·8v
TX
C37
C36
RFC1
R22
R23
RFC3
C30
R16
C25
C26
TR9
TR5
R13
C22
KEY
R15
R20
R14
TR7
P.A.
C31
L2
L3
L4
ANT
TX
C23
TR6
PREDRIVER
DRIVER
R19
RFC2
C32
C33
C34
C35
TR8
R17
C24
R18
R26
C27
R21
C28
R24
R25
C29
-G0FUW-
G-QRP-C 2196

FIG. 1



COMPONENTS



TRACK

P.C.B. LAYOUT

Description
The "Alpha" is an 80 metre transceiver CW transceiver which features VFO control, RIT (receiver incremental tuning) and variable RF gain. The simpicity of the design keeps down the cost and ensures greater reliablity. The VFO covers 3.5 to 3.8mHz (with a 50pF variable capacitor) and the RIT gives a shift of 2 or 3 kHz either side of the transmit frequency. The receiver uses the familiar direct conversion principle to good effect, with an FET pre-amplifier to give lots of gain. Many European stations have been heard on both CW and SSB. The transmitter gives a good 2 watts output which is very usable on he band. The transceiver switching is effected by a double pole switch, shifting the antenna and the 13.8 volts from receive to transmit; a bit crude but it works.

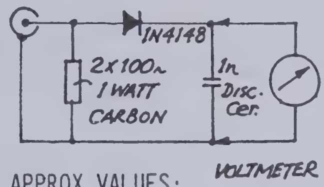
Background
The rig came into being when I wanted something to leave at my parents house, to use /A, hence its name. 80M seemed a good choice as there is always some activity on the band. The basic building blocks came from various sources, RSGB publications, SPRATs and others. I have modified each of the boards slightly to suit this application and the DC receiver is a combination of a number of ideas.
The information given here should be enough to put together a good working copy. I have included circuits, PCB layouts, component lists and notes for each stage of construction. If anyone needs additional information or requires an answer to a specific query, then please contact me.

Transmitter and Low Pass Filter

R15 10K R16 3.3K R17 390R
R18 330R R19 5R6 R20 470R
R21 100R R22, 23, 13 1K
R24,25 10K R26 39R
C22, 23 19nF Polyester
C24, 25, 26, 27, 28, 29, 31, 36, 37 0.1uF Polyester
C32, 35 470pF Polystyrene Close Tol:
C33, 34 1200pF Polystyrene Close Tol:
C30 100uF/25V
TR5 2TX751 TR6 BC108
TR7, 8, 9 BFY50
L2, L4 22T 26SWG T50-2
L3 25T 26SWG T50-2
RFC1 1m5
RFC2, 3 8T 32SWG on ferrite bead
TO5 Heatsink = 3

QRP addicts may recognise the basic transmitter from the PW Dart Top Band transmitter. I have used this modified version on 80 and 40M with good results. The PA and the driver transistors run all the time with 13.8V applied, with the pre-driver being keyed.

TEST EQUIPMENT



APPROX VALUES:

1w = 10 VOLTS
2w = 14 VOLTS
3w = 17 VOLTS

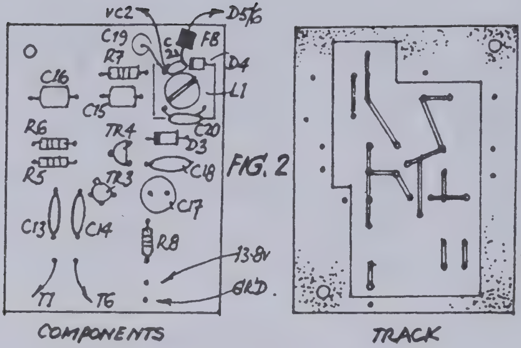
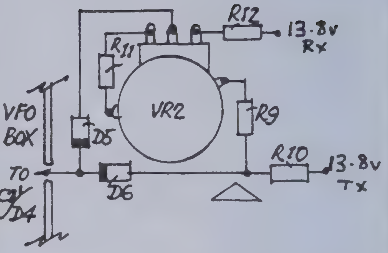


FIG. 2

P.C.B. LAYOUT



RIT Layout Component List

R9, 10, 11, 12 10K
VR2 10K Lin
D5, D6 IN4148

VFO and RIT PCB Component List

R5 1K
R6 820R
R7 100K
R8 390R
C13, C14 10n Polyester
C15, C16 220pF Polystyrene
C16 470pF Polystyrene
C17 33uF/25V
C18 0.1uF Polyester
C20 100pF Silvermica
C21 39pF Silvermica
VC2 50pF C804 or 25pF C804
L1 see notes

TR3 BC107
TR4 2N3819/J304
D3 5.6 Zenner
D4 BA102/105

Notes
L1 was originally 30T, 30SWG on a 3/8" former but I used 40T 32SWG on 1/4" former. Keep the leads short.
If only 3.5 to 3.6 MHz required
VC1 = 25pF.

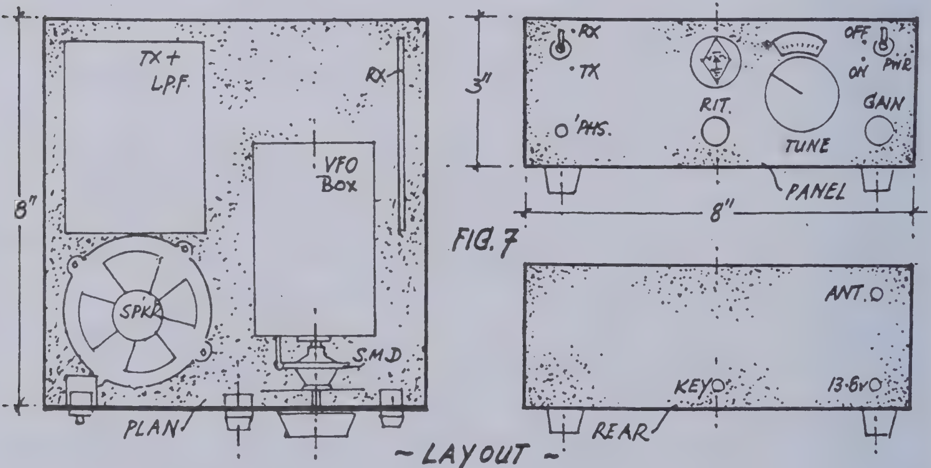


FIG. 7

~ LAYOUT ~

Metalwork

Case (8"x 8"x 3") e.g Minffords J19
Box (4"X 21/2"x 23/4") e.g Maplins AB11
DPDT Switch

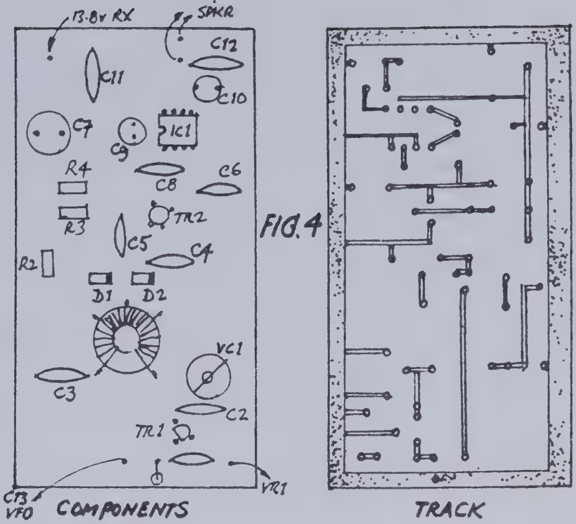


FIG.4

COMPONENTS

TRACK

P.C.B. LAYOUT

Receiver PCB

R1 1K R2 3k R3 5M6
R4 10K
C1, 3, 4, 5, 6, 8, 11, 12, 0.1uF Polyester.
C2 180pF Silver Mica
C7 470uF/25V C9 4.7uF/25V
C10 47uF/25V TR1 2N3819/J304
TR2 BC109, BC549 etc
D1, D2 IN4148
IC1 LM386
VR1 220R Lin
VC6 60pF Trimmer
L1 40T 32 SWG + 2x6T 32SWG on T50-2 (see Notes)
LS Small 8ohm Loudspeaker

Notes
Try to get 2 IN4148 diodes well matched on an ohmmeter, or you may use a pre-set pot in between R9 and R10. Test by measuring the voltage at junction D5/D6 on the Tx and Rx before connecting the VFO. This voltage should be the same when VR2 is at its midpoint. Use short rigid wire.

Notes
Construction is fairly straight forward and the audio amp gives ample output. Extra care is required with the mixer transformer. Wind the main coil first then twist together the two lengths of wire and wind 6 turns over the centre of the main winding. Use an ohmmeter to identify the ends. Take the start of one winding and the end of the other to the centre hole (see layout).

VC1 tunes the main winding of T1 to resonance at the centre of the VFO, or at any frequency of special interest (e.g. 3560kHz).
This circuit suffers less from BC breakthrough than many others I have tried.

THE 'HOVER' LOOP ANTENNA

By Mike King G3MY

The HOVERLOOP is basically a fullwave wire loop antenna cut to the usual loop formula L = 1005/f, where f is the the frequency in Megahertz and L the length in feet.

The physical form of the loop is an inverted V with the apex at 60 ft. Each leg of the V is about 60 ft long with an apex angle of about 110 degrees. The rest of the length comprises a low horizontal V at some 12 to 15 ft above the ground.

The feedpoint is at the apex of the inverted V. The feeder comprises two equal lengths of low loss UHF TV coax, giving a screened balanced 150 Ohm feedline. Measurements have shown that the loop has a radiation resistance of about 110 Ohms on 3.5 MHz, rising to around 220 to 250 Ohms on 28 MHz. I have not measured it on 50MHz.

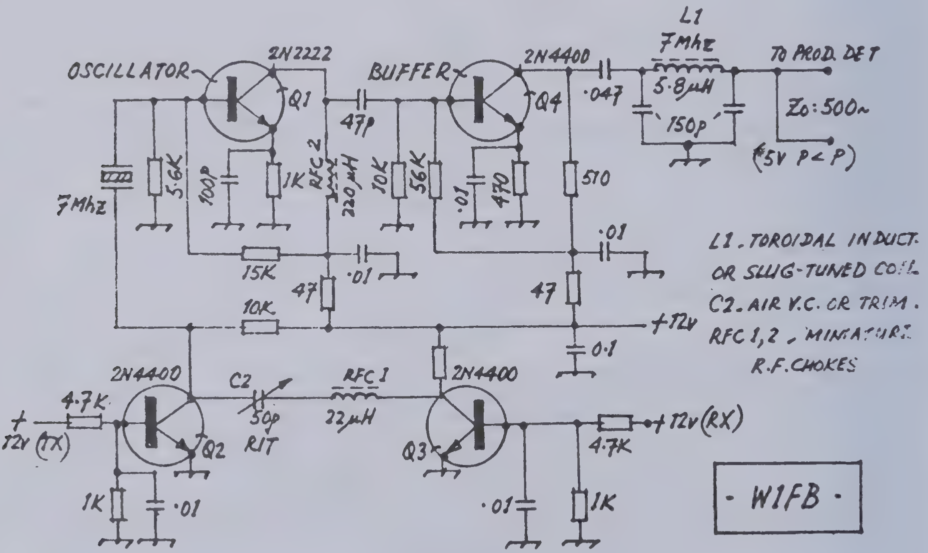
If a valve type PA is used the two feeders can be brought into a simple 1:1 bauln on the back of the transceiver and the Pi network will match it satisfactory. When using a solid state PA I use a small QRP 'Z' match to tune out the reactance on the higher frequency bands.

On 160 metres it is possible to use the antenna in one of two modes:

1. as a 'fat' quarter wave against earth with the two feeders in parallel to give a 37.5 Ohm feeder.
2. The lines can be tuned at the bottom end to give a voltage feed to the two free ends of a halfwave antenna, and although this puts a high SWR on the line the losses do not seem to be too excessive.

I hope this will be of some interset to you...it has brought me 65 DXCC countries since September 1987 so I am happy with the results so far.

HOVER LOOP comes from HOrizontal/VERtical of course!!



A TEETER-TOTTER LO FOR DC TRANCEIVERS

By Doug DeMaw, W1FB

Perhaps you Sprat readers may be interested in a local oscillator circuit that permits RIT operation in a fixed frequency, crystal controlled DC transceiver. The same crystal is used for both transmit and receive.

In the transmit mode, an NPN dc switch places the crystal in the path to ground. When the TR voltage is applied to the base of the remaining NPN switch (03) the oscillator becomes a VXO and Q2 shuts down. With the Q1 circuit shown, the VXO part of the circuit allows a 40-metre AT cut crystal (30 pf load capacitance) on an HC-6/U holder to be shifted approximately 2kHz above and 2 kHz below the marked frequency.

The frequency shift for an 80 metre version of this circuit will be substantially less...roughly +500 Hz and -1kHz if RFC1 is 50uH and the series variable capacitor is 100 pf. For 20 metres, RFC1 is reduced to 12uH, and the variable capacitance has 25pf maximum capacitance.

There is no reason why a VXO type of circuit cannot be used for both the transmit and receive modes. The Q2 circuit can be changed to allow VXO operation during transmit. A second RF choke and variable capacitance would need to be added. I developed this circuit for a very compact, emergency type 40-metre transceiver, hence the fixed-frequency mode during transmit.

Care must be taken with this circuit to avoid the oscillator starting when either Q2 or Q3 are not conducting. Double-sided PC board should not be used for this circuit. The small stray capacitance to ground from the crystal holder will cause Q1 to operate, even when there is no forward bias on Q2 or Q3. Single-sided PC board is essential.

The only problem that I see when using a VXO for both transmit and receive is trying to have both VXO circuits track. In other words, the receiver may be on one frequency while the receiver may be on another. Dial calibration should take care of that problem owing to the presence of two tuning controls.

The buffer/amplifier is designed to look into a 500 ohm load, such as the base of a class-A driver stage that is keyed. The pi-section collector network for Q4 is used to "launder" the output waveform. This helps to provide a cleaner waveform for injecting into the DC receiver detector. The advantage of a keyed class-A driver stage is that it provides a better keyed wave shape (less clicky) than can be obtained from a class-C driver.

Q2 and Q3 may be activated by means of a manual switch, or you can use solid-state switching to turn the NPN switches on and off. Although 2N4400 transistors are specified you can use 2N222s or equivelent devices. The 10K resistors to the +12V supply are needed at Q2 and Q3 in order to bias them for non-conduction when they are in the turn-off mode.

If you build this LO for bands other than 40 metres you will need to find a suitable value for C1(feedback capacitor). The constants for L1 and the associated capacitors will need to be changed also, along with the value of RFC1.

USA MEMBERS

Some US members have asked about certain European designations in some of our circuits. For example 4K7 and 100n etc.

It is common practice to insert the unit at the decimal place - dots are sometimes difficult to see or get missed out.

e.g. 4.7K = 4K7   1.5M = 1M5

The Microfarad, uF = 10(-6), Nanofarad, nF = 10(-9), Picofarad, pF = 10(-12
e.g. 0.01uF = 10n = 10,000pF etc.

HILLTOPPER, SPRAT 52. Ken GM4JMU

In error I put the value of 3-30pF on the trimmer capacitors. While these would be suitable in most cases a 7-65pF trimmer is a better choice (yellowplastic casing in UK). Alternatively an additional 22pF across the 10mHz trimmers should solve any problems.

80M QRP PA SPRAT 52. Mac G3FCK

A 120pF fixed capacitor should be shown between the output and the junction of two 100pF capacitors and the coil.

A SIMPLE 29MHz DIRECT CONVERSION RECEIVER

By John Young BRS33339

(Re-printed from Oscar News)

The receiver described is a simple direct conversion set designed for the reception of the OSCAR satellite. It was built more than three years ago and the only change to the design since then has been the introduction of two tuned circuits at the input to eliminate interference from a local AM CB station. It has been used with simple dipoles, ground planes and beam antennas, both as a fixed and as a portable station.

The circuit comprises a cascade RF amplifier using 2N3819 or 2N3823 fets, (the 2N3823s will give the better noise figure), a diode harmonic mixer (1) driven by an oscillator/buffer (2), a low noise AF pre amplifier preceded by a simple low pass filter, an AF power amplifier. The output socket J1 from the AF pre amplifier may be used to drive a tape recorder (Mic input), or may be connected to the domestic hi-fi (phone input). An LM380 IC amplifier is incorporated to drive an external loud speaker (8 to 35 ohm) or headphones.

The RF amplifier, mixer, LO/buffer, AF pre-amp. and AF power amp. were each constructed on separate boards such that future modifications may be made without rebuilding the whole receiver.

Although designed for the section of the 10 metre band allocated to amateur satellites, the receiver will operate over any 300KHz segment of the 10 metre band, (this being determined by the bandwidth of the RF amplifier). When setting up the receiver for the first time, it is recommended it be tuned to the SSB portion of the band, and when working satisfactorily be re-tuned to the satellite portion of the band. The setting up procedure is as follows:-

Set the oscillator tuning capacitor to full mesh and its associated 3-30pF band spread trimmer to half mesh. Tune the oscillator to 14.250MHz by adjusting the tuning slug in L2. The 1K pre-set pot (set LO) should be at 75% of maximum. The frequency of the LO may be checked against another receiver or by a frequency counter connected to the source of the buffer amplifier, (via a 1K and 0.1uF in series).

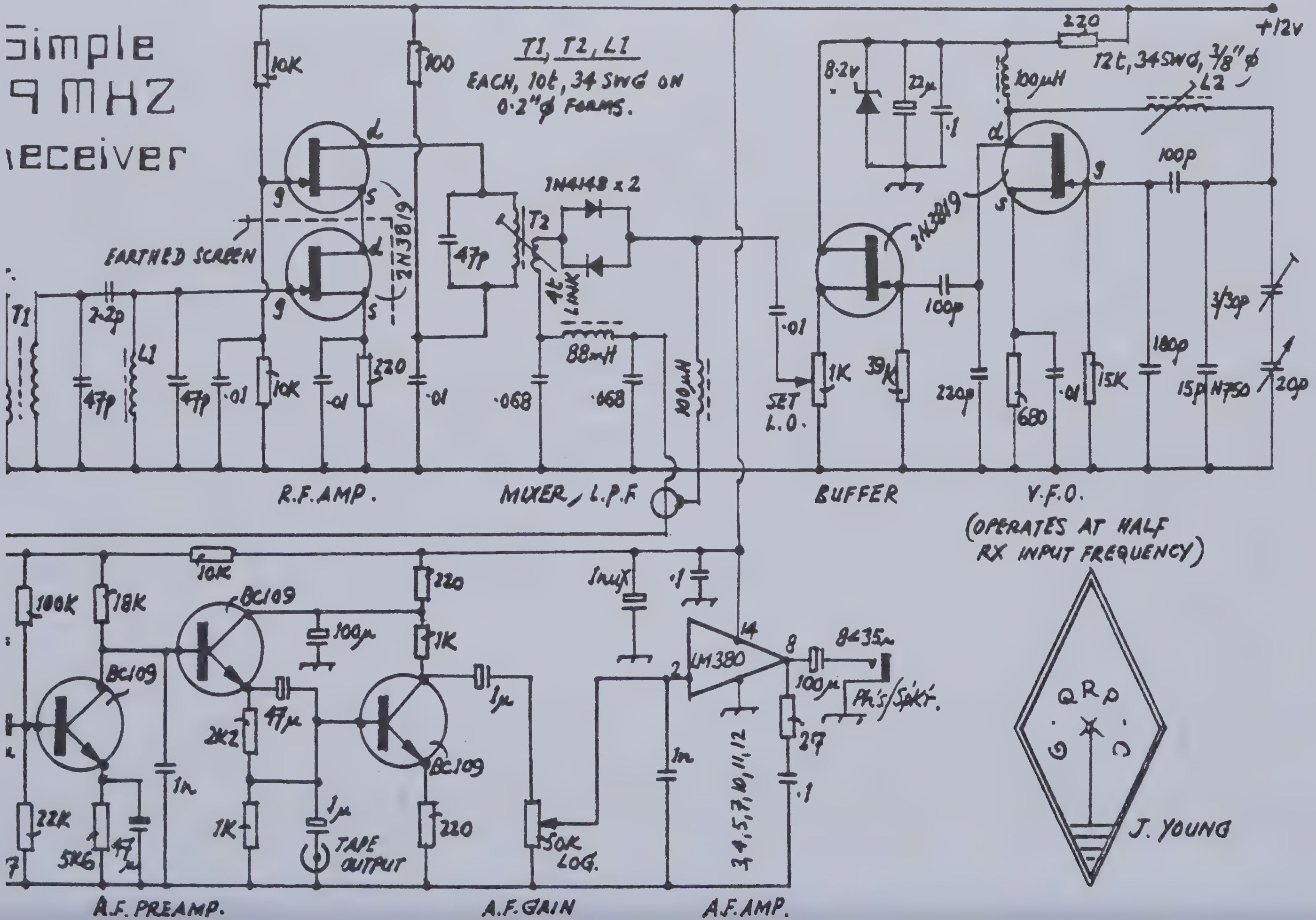
Connect an antenna and headphones. Turn up the AF gain until a hiss is heard in the headphones. Tune T2, followed by L1 and T1 for maximum increase in noise output. Tune the LO until an SSB station is heard and re-peak T1, L1 and T2 for maximum output. When the receiver is operating satisfactorily, retune the LO to 14.725MHz and peak up T2 followed by T1 and L1.

If you now disconnect the antenna there will be a noticeable drop in the output noise level, even if you live in a quiet rural area. Connect and disconnect the antenna while adjusting the LO drive for the highest ratio of antenna noise to receiver noise. Finally, by adjusting the bandspread capacitor and L2 alternatively, set the LO to cover the range 14.700 to 14.750MHz at the 10% and 90% points of the main tuning dial.

(1) Pat Hawker G3VA. Russian Direct Conversion Demodulator. "Technical Topics", Radio Communication, April 1977

(2) J. Young BRS 33339. The Cadet DC Receiver for the Novice Radio Communication, October 1973

Simple 9 MHZ Receiver



THE UNO

FINBAR O'CONNOR EIOCF

Over the many years of SPRAT there have been quite a number of simple transmitter circuits, particularly two transistor types and occasionally single stage ones, provided their limitations are understood they can provide lots of fun and emjoyment. There is also to my mind a practical aspect. The more simple and straightforward the project the more likely it will be started and finished. With this in mind I offer fellow members of the club the UNO receiver. I have been fascinated for some time with the idea of a single stage RX. The UNO does work, but the construction does need a little thought, not that its unusual or difficult. To ensure it works first time make sure you follow the winding details on the toroidal core, get it wrong and the RX will play dead. It will just sit there and stare back at you and no end of the usual poking about with various capacitors and bits will launch it back to life. The RX works on the regenerative principal L2 and VC2 are the components to achieve this. As you can see VC2 is insulated from ground so is VC1 and VC3 and will probably prove to be the most difficult problem to overcome. VC1 though can be made a trimmer, it is in my UNO, and then adjusted to the required frequent using VC3 for bandspreading. My first UNO worked a treat built on vero board. When I made a lash up using vernier dials and with it spread out a bit more it howled and squealed and was totally unstable and unusable. Back I went to the vero board and added 2 more capacitors to tame it down and we now have a fine usable RX. If you don't have access to HI z phones a LT700 transofmer can be installed and 8 ohm phones used. Using this receiver is fun and reminds me of my days as a radio officer in the Merchant Navy when we used the old Marconi Oceanspan transmitter. There were dials all over it, blue ones and red ones and white ones. One kept a chart of settings so as to know how to get back to the same set up in the event of changing frequency. One aimed for aerial amps and it was known for a heavy book to be put on the key to burn off the moisture on the aerial. What to joy to see the RF amp meter needle rise up. This strong element of hands on operation of radio equipment was normal then and the UNO operation reminds me of my sea time. You work at getting this RX to come to life but there is a definite feeling of really having wrung the signals out of the antenna, after all theres not much between your headpohones and the antenna. I suppose you could say you're as close to the other station as anyone. You have done away with the input circuits, RF stages, detection stage and audio stages. Whewww!!!!

Now for the draw backs. The UNO does require a good antenna.... In other words, give it a chance and get plenty of wire up and if possible a good earth will help too. If you change the antenna length, even slightly you change the RX frequency, the same goes for VC4, antenna coupling, change it and you will have to re-set the main tuning trimmer. However under normal circumstances the antenna in use should remain the same and 500 pf for the antenna coupling seemed to work for me, but a trimmer could be used there instead, I would suggest you built the easy xtal osc as in Fig 3 and use it as a signal source for finding your favourite spot. That is provided you don't have a signal generator or a transmitter with a VFO. Keep the output from any of these generators as low as possible as its very easy to overload this kind of RX. The feedback capacitor VC2 is advanced until one notices the proper sound from CW stations, go on advancing VC2 and eventually the RX starts to howl. That fellow operator is too far, back off a bit. What you will find in practice is that there is an optimum setting for VC2 and you will know it from the way your RX works. For example, you have set up VC1 (main tuning) for 3550 KHz with VC3 half meshed advance VC2 to just get regeneration. Now start tuning HF ie. towards say 3560 KHz. You will find the RX becomes more sensitive as you go higher and higher in frequency. Stop and to back to mid positon of VC3, now tune LF. What you will find is that the RX will drop out of regeneration as you progress LF. You can see the original setting of VC2 is not just right for tuning this portion of the band. Conversely advancing VC2 close to that howling position mentioned earlier means that when tuning HF, almost immediately the howling begins, tuning LF and the receiver is fine to down past 3500 KHz. So its a matter of setting it, just right, between these two spots. However knowing this, if one wants to sit on a frequency, say 3560 KHz one can hot up the RX with VC2 on that spot, ie. advancing to just below that howling level.

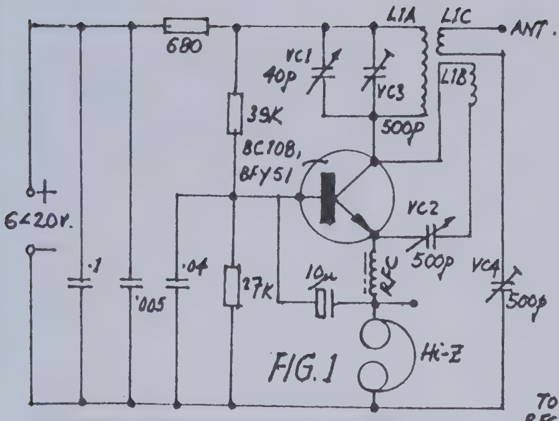


FIG.1

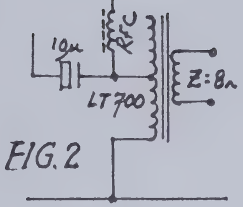


FIG.2

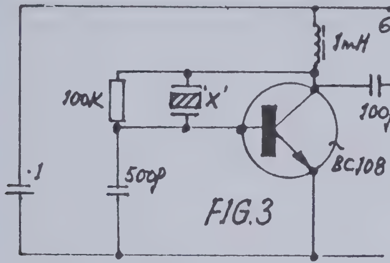


FIG.3

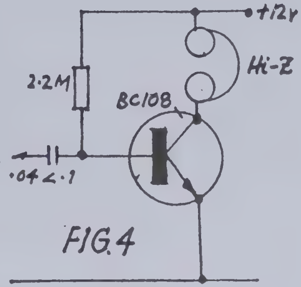


FIG.4

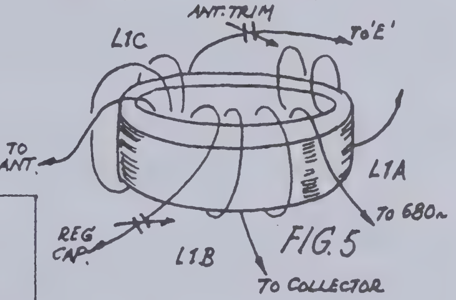


FIG.5

"UNO" RX

FINBAR O'CONNOR ~ EI0CF ~ 208

L1A ~ 34t 26 SWG
L1B ~ 6t 24 SWG } T50-2
L1C ~ 9t 24 SWG

RFC : 10<20μH, OR 6t 28SWG ON F.B.

Regarding operation with a transmitter, netting of the RX will require a low level of voltage to the test osc or TX. I needed to reduce my single stage TX supply to 4 volts before the UNO came unstuck from overloading. It is possible to stick on a single stage of audio, Fig 4, but its really not necessary and it takes away from the basic idea. I heard a PY at the top end of 80 meters recently on UNO and although I didn't understand much of what he said it was a great thrill all the same. I'm now working on coil details for 40 meters. The coil for this 80 meters covers from about 3 MHz to 4.2 MHz, so you can listen to aircraft frequency, like Shannon Air Radio, on 3016 KHz and Gander in Newfoundland who I heard at about 2300 GMT a number of weeks ago on their 3 KHz Volmet frequency.

I hope you get as much enjoyment from UNO as I did developing and using it. Long live simple ham radio!

THE UNO ON 40 METRES : Finbar O'Connor EIOCF

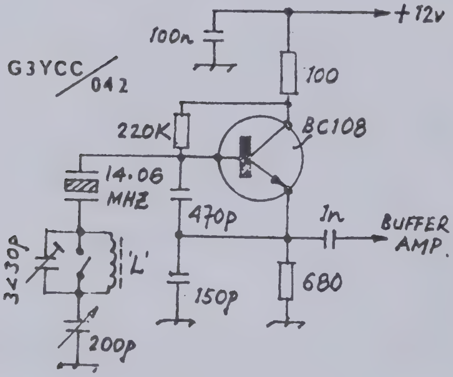
The UNO can be made to go on 40m by replacing VC3 by a 80pF variable, in my case I used two trimmers of 40pF. Additionally VC1 needs to be reduced to about 10 (or 5) pF, the original 40pF gives too much bandspread. Finally VC2 needs to be reduced to about 100pF or less - try different values. With the 80m VC2 value, the Rx takes off even with the minimum value presented by the 500pF variable, so its a matter of reducing the value until the required regenerative action occurs. These capacitive changes refer to the original coil which remains unchanged. VC4 could be reduced to a 40pF variable.

I used the simple audio amp, Fig.4, on 40m and the receiver worked a treat. I would suggest that one uses a small antenna with this configuration. Anything from 2 feet to about 15 feet is all that is required. I have re-examined the 80m set up in the light of the 40m with the UNO. My conclusions are that having tried the UNO as a one transistor RX, one should move to the 2 transistor version and reduce the antenna length to the minimum required.

Again only a few feet of antenna, rather than tens of feet and stick with a PP3 battery rather than a mains derived supply. The receiver will operate down to about 4 or 5 volts. The VK and JA stations I heard on 40m were a real uplift after all the mucking about with the circuit. There were nights when I stumbled down the shack stairs at 3am having been defeated in my efforts, vowing to chuck the lot in the bin and take up.....well, anything other than amateur radio. Now I'm working on a VHF transmitter-it works but there have been a few problems recently and I'm looking the for"bin again...

A VERSATILE VXO
Frank Lee G3YCC

Some years ago I had a rig for /P use based on the SCD TX. This had limited frequency swing on 14MHz so this circuit was employed. L1 is wound on the ubiquitous 1/4" former with core : 22 turns of 26swg. the 3-30pf preset is a Beehive or similar trimmer. A 200pF (approx) was a scrap item. Very short wires go to the single pole switch which cuts out L1 and trimmer. By adjustment of the trimmer and L1, the required coverage can be achieved from the 14.060MHz crystal. I found with the switch open the coverage was 14.043 - 14.059 and when closed it was 14.060 - 14.065. More swing can be obtained but at the cost of stability, lack of drive and perhaps crystal damage.



VERSATILE VXO

WHY YOUR MEMBERSHIP MAY HAVE BEEN LATE! David, G4HYY, our Membership Secretary during his long continental holiday stayed with DK4UA (Rudi:2901). They both worked G3RJV/A using George's old Argonaut 515! David also visited DJ4SB, Gerd in Mannheim. Gerd runs and HW8 and a wire dipole with open feeders - most unusual in Germany. He is very interested in experimenting with reduced power via an attenuator down to uW levels.

MEMBERSHIP HANDBOOK CALLSIGN-NAME LISTING

Due to an error in communication, some joint husband wife memberships have not been recorded. Omitted from the listing are :

2008	G8GGR	
2777	G1IJW	Jo-Anna
3550	G0AQX	-
4575	G8WWO	Jennifer
3041	G1GZB	Val

IAMBIC KEYER

G3ROO/G4ZQK

FEATURES

- Full Iambic operation
- Very compact
- Very low consumption, not worth including a power switch!
- Dot and dash memories
- Negative and positive solid state output keying
- Keying output up to 40 volts >100mA

Recently when talking to Jack G4ZQK he mentioned that he had a very neat little Iambic key PCB that he used. He has kindly allowed us to produce his board for club members.

The design is complex and we have not yet completely worked out the operation, this will be done on our next meeting! As we see it on the left hand side of the drawing Ic1 a and b form the dash memory, Ic1 c and d the dot memory, these are reset by Ic3 a and Ic3 d respectively. It would seem that Ic2 forms the dash and Ic5 forms the Iambic operation. Ic4 forms the clock and gating functions.

CONSTRUCTION

This board is very compact, and a fine iron and fine solder must be used to reduce the chance of solder bridges. Once the board is complete IT MUST BE VERY CAREFULLY CHECKED OVER FOR ANY BRIDGES AND THESE CLEARED. Connect a multimeter on its current ranges in series with the supply and connect supply, the current drawn should be less than 1 microamp.

Now remove supply and connect a minature 12 volt bulb between the + and o/p terminals. Reconnect supply and using a fly lead connected to the negative terminal touch the dot terminal and the lamp will flash indicating keying. Now touch the dash terminal and the lamp will flash alternatingly indicating dash dot dash dot dash dot etc.

When connecting to the paddle convention dictates that the dot is formed by the thumb and the dash by the index finger of the right hand. We know of several people that did not realise this and taught themselves the other way around. This is fine but does cause problems when someone else uses your keyer!!

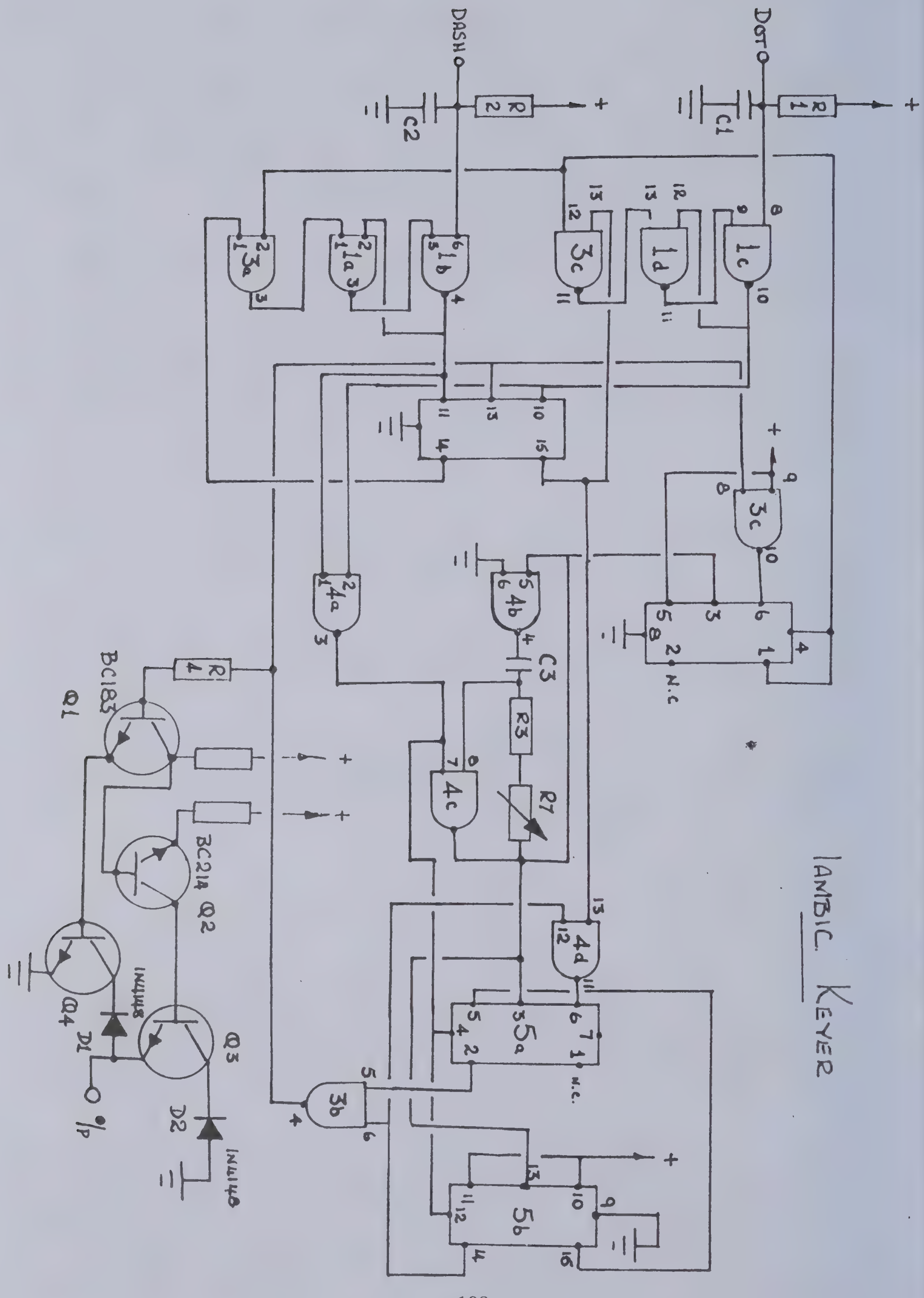
Components for IAMBIC KEYER

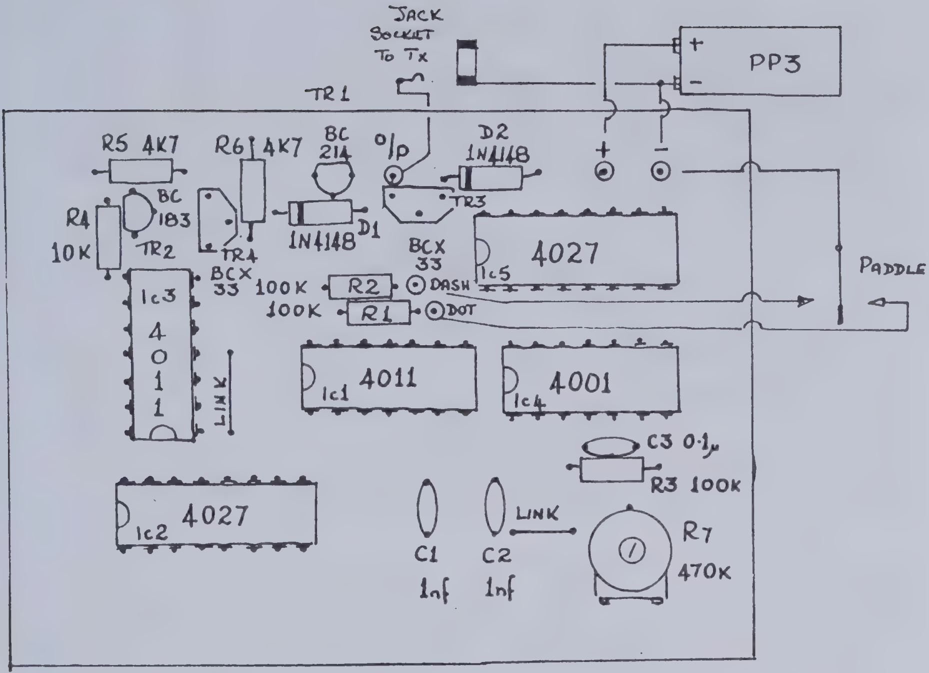
PART	VALUE	PART	VALUE
R1,2,3	100K....................	TR1	BC214.................
R4	10K.....................	TR2	BC 183................
R5,6	4K7.....................	TR3,4	BCX33.................
R7	470K LIN PRESET.........	IC1,3	4001..................
C1,2	1NF (0.001 OR 102).....	IC2,5	4027..................
C3	100NF (0.1 or 104).....	IC4	4001..................
14 WAY SOCKETS.....................		16 WAY SOCKETS...................	

The Kit of parts is avaiable from
KANGA PRODUCTS
3 Limes Road
Folkestone
Kent
CT19 4AU

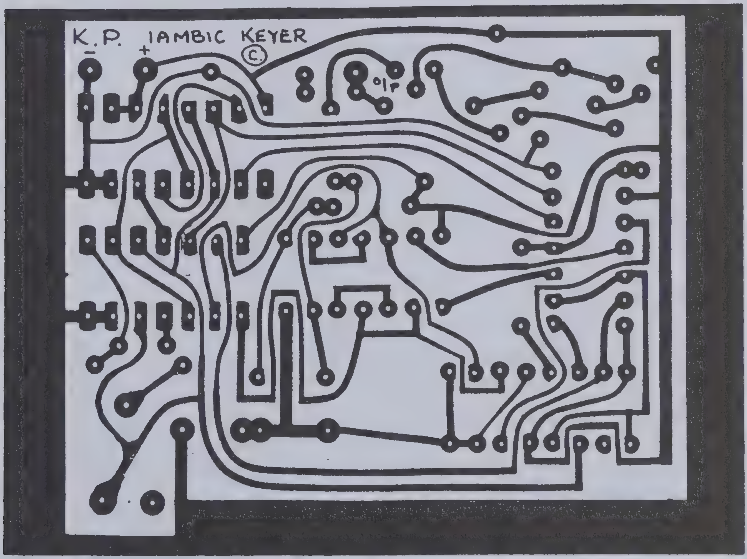
For 12.45 plus 85p postage and packing

IAMBIC KEYER





IAMBIC KEYER



HOME BREW DIODE MIXERS

Robert van der Zaal PA3BHK

In direct conversion receivers factory made Schottky Diode mixers like the SBL 1 and the MD108 are commonly used. Although they are very reliable devices, they have one disadvantage : they are too expensive for a students purse. So I looked for an alternative and found from some Dutch magazines, that is was possible to make them. Klass, PA0KSB, gave his view on the subject in ELECTRON magazine (1) and the local amateur radio magazine at the university suggested practical methods (2).

Opening a factory made mixer shows two small transformers and four diode as in the circuit of Fig.1. The diodes are Schottky Diodes, like BA481 (Philips) and HP2800. The transformers are wound on small ferrite beads. So any handy amateur can build such a device, perhaps not as small but certainly as useful.

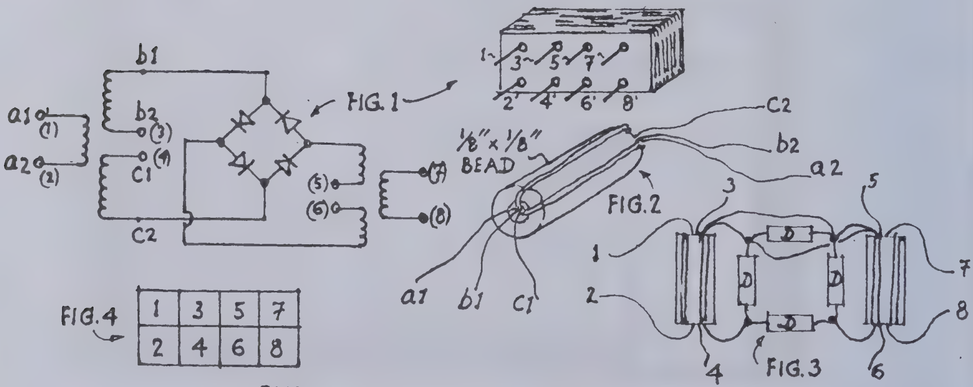
The transformers are as shown in Fig.2. Carefully twist three lengths of 30 swg, or thinner, enamelled wire, each about 3" long and make two or three trifilar windings. The four diodes are soldered in a "square ring". If the mixer is to be used below 30MHz and Schottky Diodes are not available,ordinary switching diodes like the 1N4148 perform well - perhaps even to 50MHz. Fig.3. shows the set up and Fig.4. a possible board layout to mount the mixer. The numbers in Fig.s 3 and 4 refer to the numbers in brackets of Fig.1. If pins are soldered through the board of Fig.4, the mixer can be compatible with factory made devices. But when the mixer is to be used on a PCB, the transformers can be soldered in the PCB with the diodes resting on the ferrite beads as in Fig.3.

I use homebrew mixers in several circuits. One serves me very well in a 2m converter (144 - 28MHz). Another is used in a universal unit for a DSB/CW transceiver which only needs a local oscillator, a PA and (for VHF) a pre-amp. This unit has been tried on 145MHz with a small xtal transmitter as L.O. driving about 50mW in the mixer, resulting in a QSO over about a mile with the HF end of the mixer connected to the 9el. yagi.

Now the unit is used in a 20m transceiver. The DSB was heard by an amateur half a mile away, with the mixer connected directly to a G5RV antenna. No QSO was made on 20m because the station only had a piece of wire (few feet indoors) as an aerial. But I heard myself via 2m FM, so the first cross band contact was made. Hopefully the 20m rig will be finished this summer, so I will be able to work other members during short skip openings.

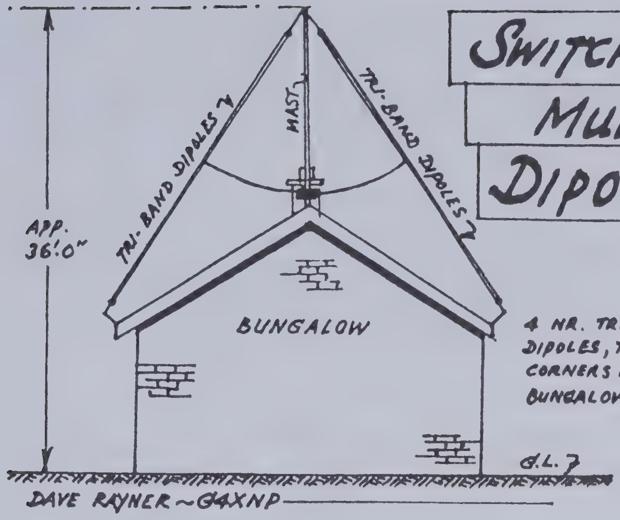
1) K. Spaargaren, PA0KSB, RINGMODULATOREN MET SILICUMDIODES
ELECTRON. August 1978

2) J. Frankot, PA0JGF, SCHOTTKY RINGMIXER (woor zelfbouw)
TWENTE BEAM. February 1984



~ ROBERT VAN DER ZAAL ~ PA3BHK ~

SWITCHED MULTI-DIPOLES

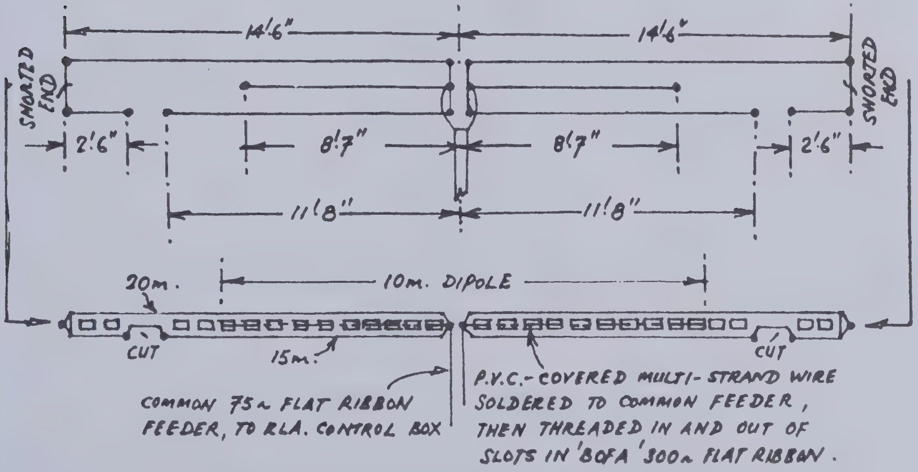


This is basically the sloping dipole system of Chris Page, G4BUE, but with each set of 3 dipoles to each corner of my bungalow.

75 ohm flat twin feeders to relay control box on chimney with control going to shack in roof space. Top of pole about 36 feet above ground.

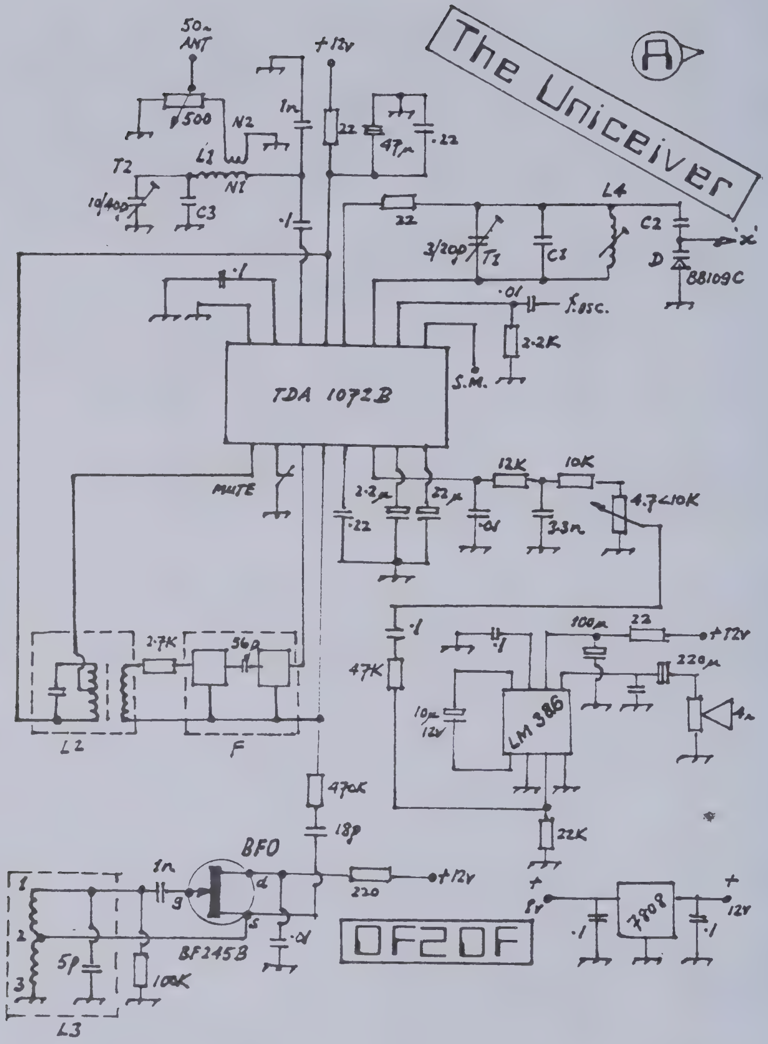
"Schematic" Diagram showing construction of dipoles for 10,15,20m

Lengths from G4BUE article on slopers


14'6"
14'6"
SHORTED END
SHORTED END
2'6"
8'7"
8'7"
2'6"
11'8"
11'8"
20m.
10m. DIPOLE
CUT
15m.
CUT
COMMON 75Ω FLAT RIBBON FEEDER, TO RLA. CONTROL BOX
P.V.C.-COVERED MULTI-STRAND WIRE SOLDERED TO COMMON FEEDER, THEN THREADED IN AND OUT OF SLOTS IN 'BOFA' 300Ω FLAT RIBBON.

Cut BOFA Feeder as Shown : Short and Solder ends

The 10m dipole is plastic covered multistrand wire soldered to common feeder and threaded in and out of the slots in the BOFA 300 ohm Flat Ribbon Feeder.



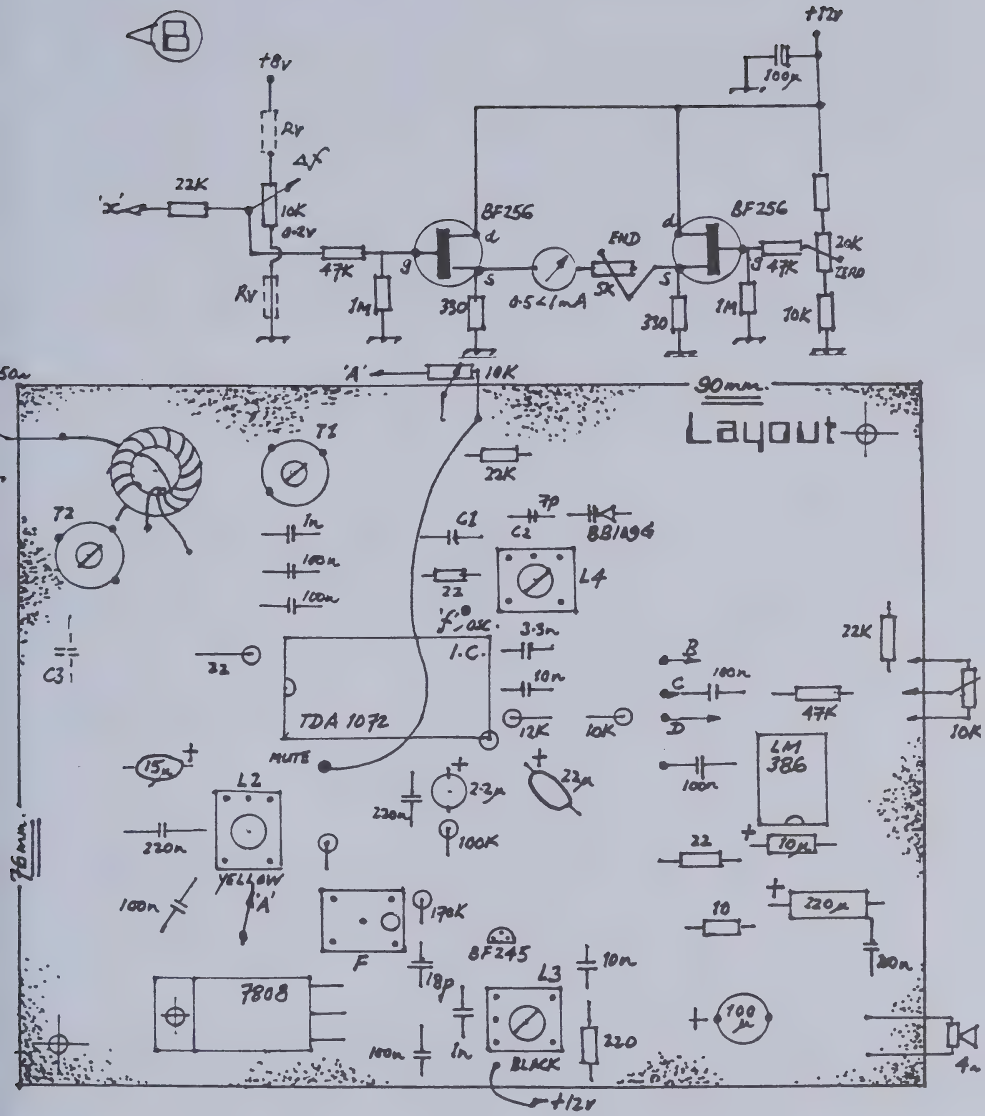
OSCILLATOR: L4

Band	L : uH	Neosid	C1	C2
1.8	not tested	5890	▪	18p
3.5	42uH	5019	39p	47p
7	8	5800	47	7
10	3.3	5044	39	7
14	3.3	"	18	7
18	3.3	"	10	12
21	2	5021	10	7
24	1	5041	10	7
28	1	5041	▪	7

INPUT: L1 (N2: 2 to 3 turns on N1)

Core	N1	C3	mm	L: uH
T502	90	330p	0.2	31
"	90	▪	0.2	31
"	45	50	0.4	10
T506	29	▪	0.5	3.1
"	29	▪	"	3.1
"	20	▪	"	1.6
"	20	▪	"	1.6
"	18	▪	"	1.3
"	16	▪	"	1

L2: Toko L4100 A yellow, L3: Toko 4202, F: SFD 455 (or try CFW455HT)
NOTE from G3RJV: If Neosid coils are not available try Toko coils the inductance values may be found in the Cirkit or Bonex catalogues.



THE UNICEIVER

Matthias Rauhut DF2OF

Inspired by an article in 'QST' (the simpleceiver), I looked around to find an IC containing a complete receiver. I discovered the TDA 1072, an AM broadcast receiver for car radios etc. First experiments have been very satisfying and I decided to test the circuit for several ham bands. But enough history, here's the circuit description.

The circuit is loosely based on the application form. I added a BFO, AF pa, rf input and oscillator circuit. The TDA 1072 contains all stages from RF amplifier to AF amplifier, including IF gain, internal voltage reference, mixer etc. There are only 4 coils needed, 3 IC's and 1 transistor. All parts should be easily available and not critical. To change from one band to another it is only necessary to replace the input toroid and oscillator coil, eventually one or two C's, hi. The toroid is from AMIDON, the other coils and filter from TOKO and NEOSID. The BFO works with one FET and a IF filter, delivering a signal below 455 kHz. As IF filter I have chosen a cheap ceramic (SFD 455) one. OM's with a larg4e budget could try the CFS 455J which is designed for SSB and costs about 16 times more. Good and loud audio is provided by a LM 386 AF amplifier. Vary the speaker to get best quality. Frequency tuning is done by using a varicap diode BB 109G and a lin pot. I have divided my favourite band (cw section) into 5 parts (each 25 kHz, overlapping), using a voltage dividing resistor network and so did not need a vernier drive. For frequency readout I use a simple FET VOM with an analog instrument and a self calibrated scale.
The RF attenuator pot is good to 40m, but a special preselector would be the optimum.
There are several useful output signals:
Oscillator signal (130mV) pin 10, S meter pin 9 and pin 2 for mute. The AF could be switched off easily for QSK. Unfortunately the S meter output is only useful when no BFO is used, for example as broadcast receiver.

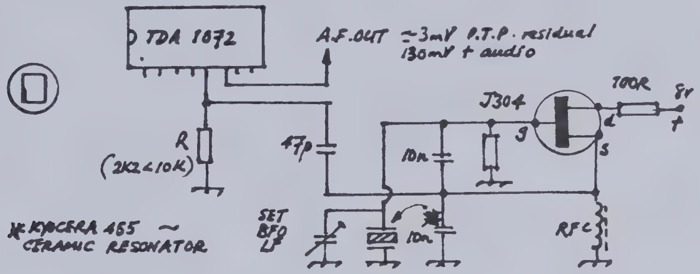
alignment:
1 All parts must be in correct place on the pc board
2 Connect speaker and pots. The alignment procedure will be simplified, if the board and pots were mounted provisional on an aluminium strip:
3 Dip the input circuit, without connecting an antenna and without using the attenuator pot.
4 After connecting the power supply, a noise should be heard. If not, you may have forgotten to ground the mute pin, hi.
5 Bring the dipper near L1 and tune the freq. until you find two spots on the dipper's scale, where a sound is heard in the receiver. There must be about 900 kHz difference between them.
6 If you hear nothing, turn the core of L3 (BFO) a bit to get better reception
7 For USB reception, set the oscillator freq. below receiving freq.
For LSB set it above the receiving frequency!
That is because the BFO can't oscillate above 455 kHz.
Set the tune pot to the ground side and align T1/L4, to get a receiving frequency just below the beginning of the band.
8 Tune T2 to get max. AF.
9 Connect an antenna, which is designed for that band and find a CW signal with the tune pot. Eventually tunbe the core of L3 slightly until the CW becomes clear.
10 Turn the core of L2 carefully to get best CW reception and AM Suppression.
11 Calculate the voltage dividing resistors Rv for the tune pot, to get only your desired segment of the band.
Now its a bit easier to tune SSB stations.
12 Catch a loud SSB signal and try to tune it clearly
Eventually turn the core of L3 and L2 VERY carefully to get good reception
13 With some patience it should be possible to suppress the undesired sideband - either of CW and ssb to a level of about 30%
14 If all alignment is done, secure the core of L4 with wax.

I am very pleased with this new RX, although it isn't as sensitive as my TS 520. Especially from 21 MHz upwards it would be better to use an additonal preamp for DX work. 160m isn't tested yet, but will be soon.
Please let me know about your experience with the RX. If there is a need I can supply the etched and drilled pc board for £6 (12 USS), postage included. a coil set should be no problem, if someone has difficulties to get them. If you are interested in already built and tuned receivers, drop me a line.

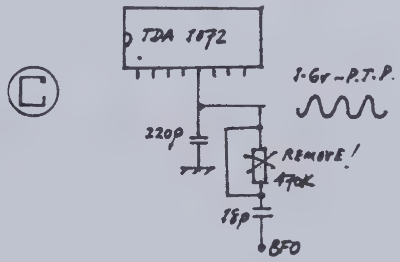
DF2OF MATTHIAS RAUHUT, Luetzowstr.13, D-3160 Lehrte, W. Germany.

NOTES ON THE RECEIVER BASED UPON LETTERS BETWEEN DF2OF AND G8SEQ.

G8SEQ:
Injecting a BFO into the TDA1072. The system used by Matthias brings the AGC into action rather early, losing the weak signals and S meter action.
It is possible to use the AM detector as a product detector by removing the .22 capacitor (pin 5) and replace it with a load resistor (10K, or the lowest value that does not stop the BFO oscillating). This works because the capacitor is to decouple IF from the AM detector : remove this decoupling and inject rf and you have a product detector. For the BFO I used a ceramic resonator in a Colpitts circuit to give several volts of injection, probably too much.



DF2OF:
The G8SEQ circuit does not work with my BFO but the circuit below does function with the original BFO circuit.
The BFO on the board shows leakage into the IF circuits and sensistivity can be improved by placing the BFO in a screened box (PCB or tinplate) Tests for this were made by connecting a meter between the S meter pin (SM) and ground. I deceide to try forcing the voltage on this line down by connecting a resistor to ground. Connecting a 470 ohm pot between the SM pin and ground (0.6 to 0,8v reading) improves the sensitivity, although I don't know why?
G8SEQ:
A better place to control the AGC line would be pins 8 or 7. Shorting pin 7 to ground should disable the AGC, so a pot here could be a useful control.



FOR SALE: TRIO 9R 59D Gen. Coverage Receiver with Spkr. 550kHz-30MHz. £35
G. Gregor, G4OWH, Police Station, Coleford, Bath. BA3 5PG.

WANTED: HW7 TRANSCEIVER, Fair to Good Cndx. Carriage to be arranged.
Photocopy of Article "Low Cost QRP Power Boosters by D.DeMaw
QST July 1987. pp30-34
GI4CBG. QTHR. TEL: (0232) 657343 (Evenings)

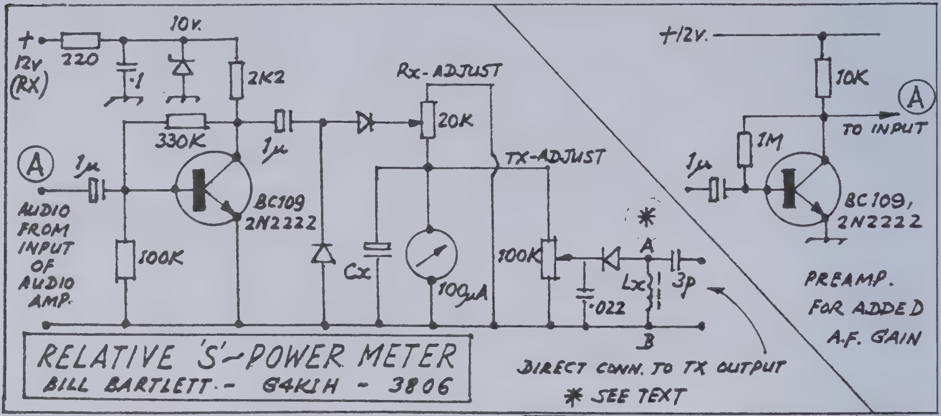
WANTED: Band Switched QRP Transceiver. Ken Hodge, GM3JIG. TEL (0294) 823364

WANTED: Old Rad Coms by W3TS. I have '82 Jan, Sept, Oct and need the rest of 82. Then I am good to 85, where I need Sept, Oct, Nov, Dec. I would pay the shipping for nay or all of these. Also wanted the German FUNK magazine for JULY and AUGUST '85 for DL3CS articles on German Spy Sets.
D.A.Michael, W3TS, POB 593-Church Lane, Halifax. PA 17032-0593. U.S.A.

ADD A RELATIVE S METER AND POWER METER TO YOUR TRANSCEIVER

Bill Bartlett G4KIH

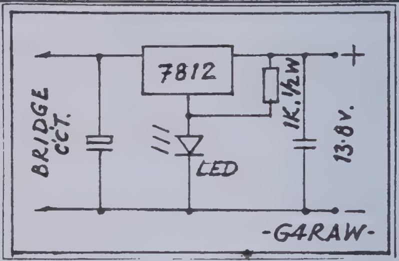
The meter was salvaged from an old CB. Cx is selected for required meter damping (say 50-100uF). All diodes are Germanium. Typical calculated values for Lx are: 80m:1mH, 40m:180uH, 20m:47uH, 15m:18uH. The pre amp can be added is required.



13.8v FROM A 12v REGULATOR

G4RAW

This circuit gives 13.8v and is useful for providing that extra bit of voltage from a 12v Reg. I.C. The heatsink tag on the I.C. is connected internally to the common tag, so any heatsink should be kept clear of ground. The LED holds the I.C. 1.8v up.



ANYONE FOR THE 1000 MILES - per WATT AWARD?

A.S.CHESTER G3CCB

Everyone knows this award with its well-intentioned aim to provide a simple measure of radio performance aginst minimal power. What is not immediately obvious is that the operator cannot stray very far from the 1 watt level without introducing a rapidly increasing error in one direction or the other. In fact, an increase in power over 1 watt will quickly reduce the change of award achievement, while a decrease in power will just as quickly enhance it!

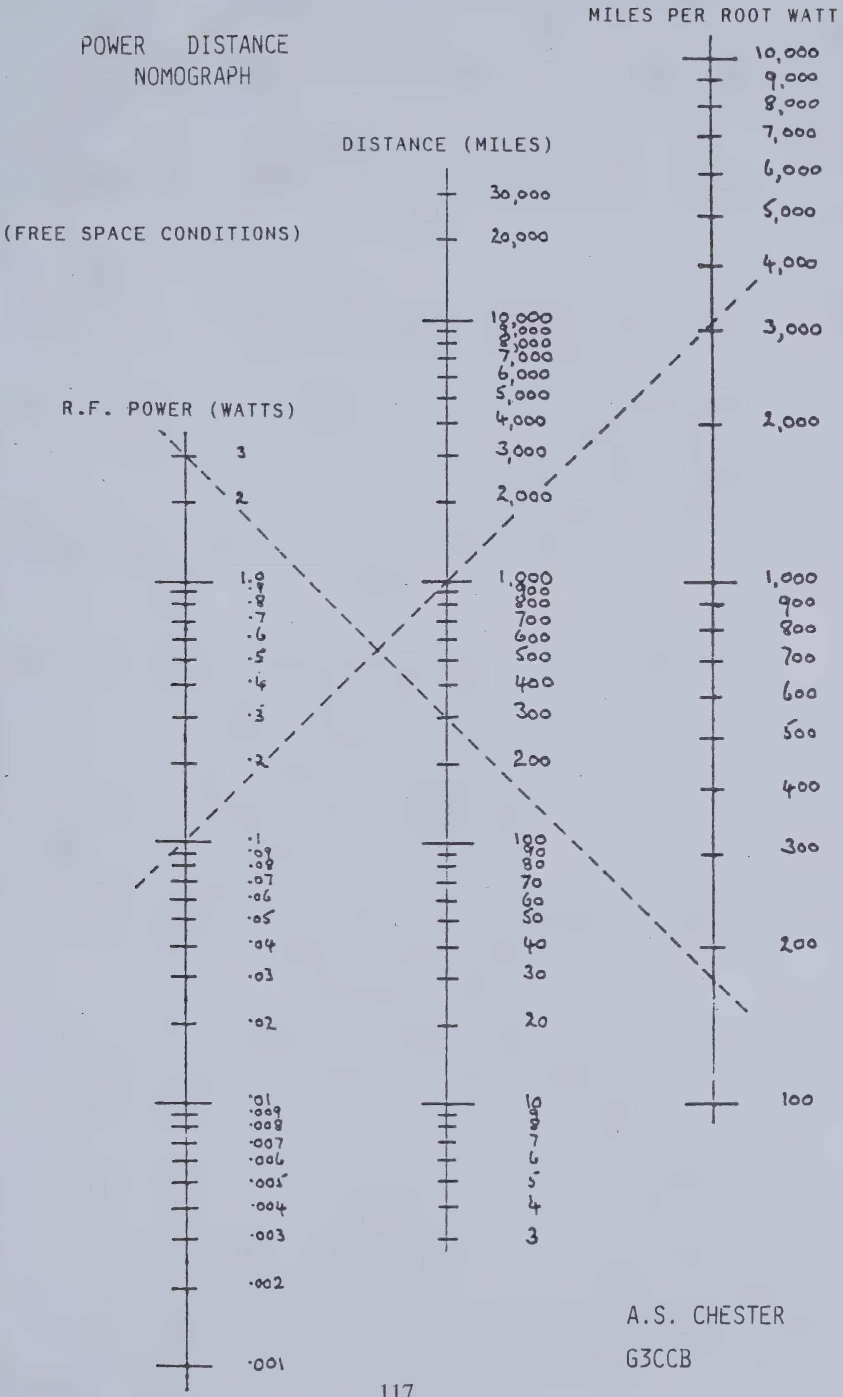
The reason for this apparently odd state of affairs is simply that the power required for radio propagation is NOT proportional to distance as the award title implies but to the SQUARE of the distance (all other things being equal) The bit in brackets is a necessary conditon which admittedly is only perfectly met in free space but the square law cannot be thrown out altogether merely to account for a few complications at ground level.

If the 'Miles per Watt' idea was ever meant to be taken seriously, and I have no reason to believe otherwise, it can be saved from extinction by observing that the distance worked must be divided by the square root of the power used to obtain a measure of performance which can only be expressed in terms of miles per ROOT Watt. This 300 miles with 3 watts will produce a modest 173 MPRW while 1000 miles with 0.1 watt will result in an award-winning 3,200MPRW

The manupilation of the square root by pocket calculator should not present much difficulty but there are often advantages to be gained in using an abac or nomograph from which relationships can be seen at a glance and limits quickly established. A chart specifically designed for the QRP operator is given.

POWER DISTANCE NOMOGRAPH

(FREE SPACE CONDITIONS)



A.S. CHESTER

G3CCB

C.W. Audio Frequency Shifter by G4VSO

Comments in Autumn 1988 copy of sprat on using audio filter at 400 Hz lead into thinking about possible filters. Many transceivers have built in 800 - 1000 Hz audio filters with fixed Tx offset or audio tone (like the KW2000). Many operators are used to a C.W. tone of 800 to 1000 Hz thus without careful use of receiver independent tuning split frequency operation could easily occur. The development of a audio frequency shifter is what is required. It has the advantage that it works with a receiver transmitter offset of 800 - 1000 Hz but audio output is at 400 Hz.

A audio shifter was developed consisting of 1.2 khz square wave oscillator using CMOS CD4011, a balanced modulator using a CA5080 transconductance amplifier and a two stage band pass amplifier using two 741 operational amplifiers with overall Q of 5. A third 741 is used to generate low impedance 1/2 rail voltage.

The principle of operation is that the CA5080 amp is used as a double balanced mixer with 1.2 KHz square wave from CMOS acting as local oscillator. The square wave switching the transconductance amplifier from an inverting amplifier with pin 5 high and to none inverting amplifier with pin 5 low (it actually forms an attenuator as amplifier and is switched off with pin 5 low) . Carrier Balance is inherent in the design and is function of amplifier offsets. The two stage band pass filters out the audio 400 Hz and amplifies the output to a reasonable level.

The circuit was built up on vero board, special precautions were taken to keep the local oscillator away from any sensitive inputs. It is advisable to have some audio filtering ahead of the circuit to reduce the level of the image at 1.6 KHz. Setting up and testing is quite simple: check that CMOS oscillator is running by measuring output on pin 10 with AC voltmeter; Connect the unit up to receiver and switch in the 400 Hz filter to check its operation. Now switch to the shifter, and listen to a C.W. station at 800 to 1000 Hz; switch in the unit and adjust the pot VR1 on CMOS oscillator to give maximum output at 400 Hz. The unit is now ready for use. The pot can be adjusted to give any frequency offset required from approx 600 Hz to 2 khz. If pot VR1 is adjusted too low so that the oscillator is about 400 Hz the output will beat with the clock and this will become audible. The output is designed to drive a high impedance of 1k or more.

References

Radcom Technical topics oct 1975 (CA5080 as balanced modulator)
Solid State Design A.R.R.L. (operational amplifier bandpass filter)

YEOVIL QRP CONVENTION 1989

SUNDAY, MAY 7th 1989 from 9am

Preston Centre, Monks Dale, Yeovil

LECTURES...TRADERS...FOOD & DRINK

Further details from Dave Bailey, G1MWM
7 Thatcham Cl. Yeovil, BA21 3BS

Component List:

Semiconductors

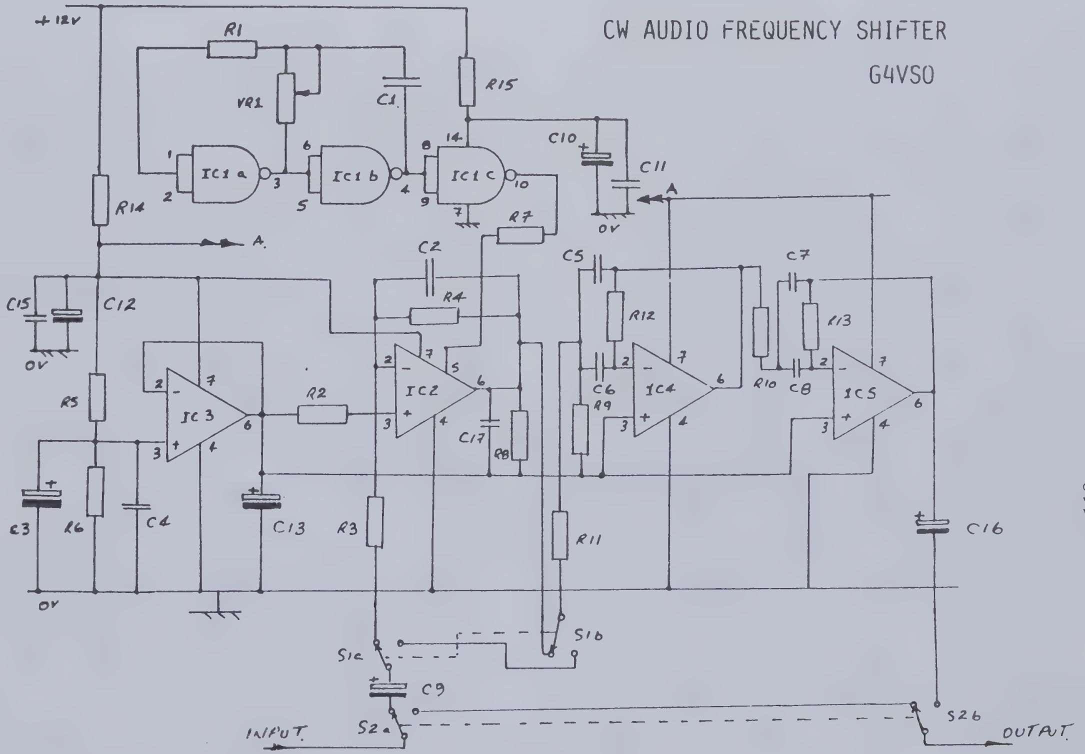
IC1	CD4011
IC2	CA5080
IC3	741
IC4	741
IC5	741

R1	1M	1/4 watt 5%
R2	1K	ditto
R3	1K	ditto
R4	1K	ditto
R5	5.6K	ditto
R6	5.6K	ditto
R7	3.3K	ditto
R8	22K	ditto
R9	1K	ditto
R10	1K	ditto
R11	47K	ditto
R12	82K	ditto
R13	82K	ditto
R14	100R	ditto
R15	100R	ditto
VR1	100k	preset or pot

C1	10n	Ceramic
C2	22pf	Ceramic
C3 C13	100uf	Tant 25v
C4	100n	Ceramic
C5	47n	Polyester or Mylar 10%
C6	47n	ditto
C7	47n	ditto
C8	47n	ditto
C9 C16	2.2uf	Tant 25v
C10 C12	47uF	Electrolytic 63v
C11 C15	100n	Ceramic
C17	390pf	ceramic

CW AUDIO FREQUENCY SHIFTER

G4VSO



Hardware

S1 SPDT shift/ 400Hz filter
S2 SPDT by-pass
0.1 Vero board approx 6in by 3in
1/4 input skt (or preferred type)
1/4 output skt (or preferred type)
Case to suit
Misc pillars nuts and screws

74HC4066, A Novel Low Cost Mixer For RF Applications
DJ1ZB

In recent SPRAT articles DK4SW and G3PDL have shown some applications of the CMOS 4066 quad FET switches. With the appearance of the HC and HCT line of faster CMOS circuits and the statement in an RCA advertising that the HC4066 would allow a control switching frequency of typically 35 MHz it was necessary to evaluate this IC for r.f. applications.

First, the four switches were connected similar to a ring modulator like a commutator switch, with both inputs floating (fed via a transformer) and one output end grounded (simplified scheme without bias).
The control inputs were connected to a quad NAND gate 74HC 132 driven by a signal generator. Operating in this setup like amixer, conversion loss was measured at about 8 dB up to 10 MHz, rising to about 13 dB at 30 MHz. Due to the relative high ON resistance compared to a diode ring modulator, operation at an impedance level somewhat higher than 50 ohms is advisable. Intermodulation distortion seemed quite low, indicating an intercept point in the +30 dBm range.

Next, the switching circuit was rearranged to introduce a bias of 2,5V to avoid limiting of the switches at high amplitudes. But in practice the improvement was low, reducing distortion at very high input levels only, without much improvement to the intercept point.

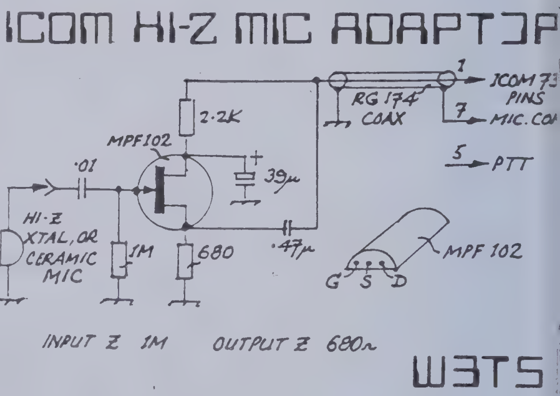
Then an rf input circuit (tunable from 7 to 14 MHz) and an AF amplifier were added to this circuit to operate it as a direct conversion receiver, with excellent results. But the 2,5V bias to the mixer caused some motorboating problems in co operation with the high gain AF amplifier. The easiest solution was to supply both parts of the circuit from separate stabilized voltage sources.

As receiving voltages are usually very low there will be no real degradation in performance when using the unbiased mixer circuit, this avoiding the motorboating problems.

For my visit to the 1988 RSGB Convention at Birmingham, where I met many G QRP C members, the signal generator was replaced by a 7 MHz VFO. The next step will be to combine this mixer with the TTL transmitter techniques already published in SPRAT to form something like a "TTL transceiver".

HI_Z MIC ADAPTOR
"Mike" Michaels W3TS

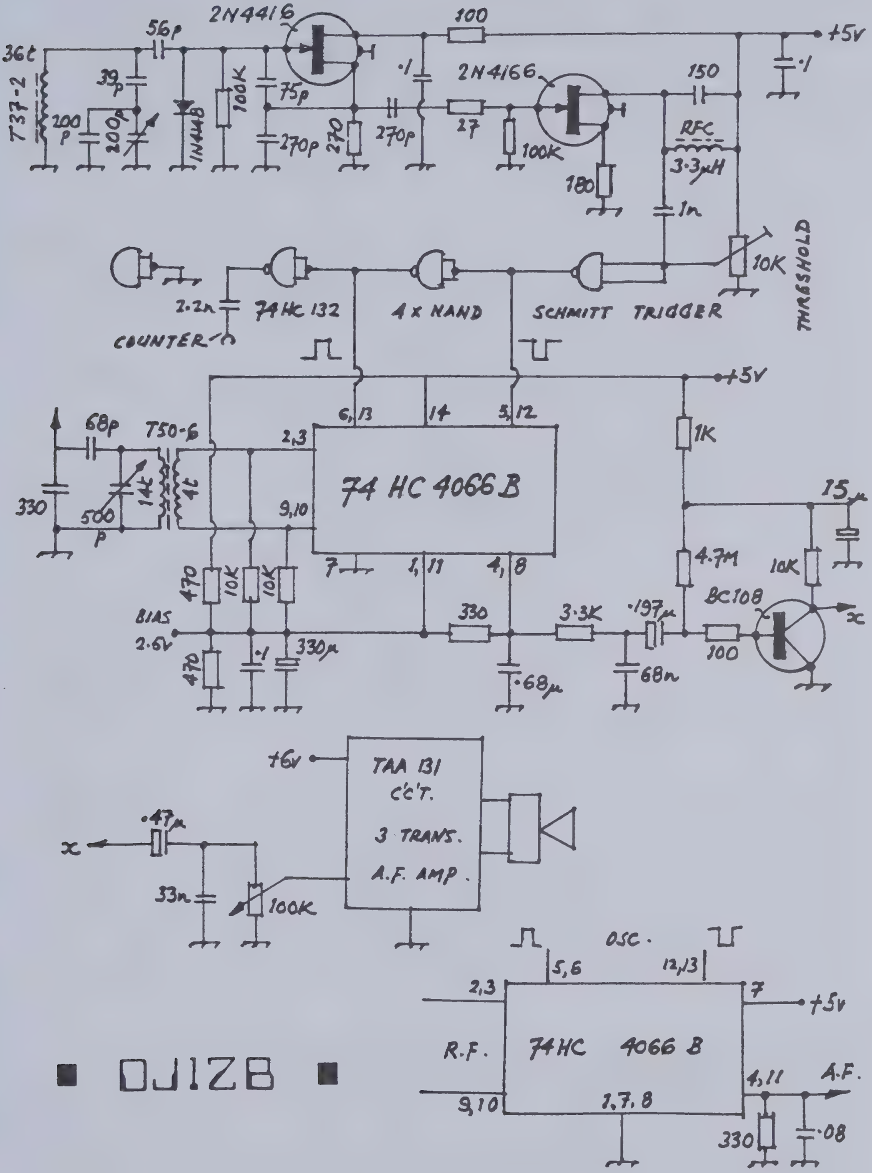
The circuit allows the use of crystal or ceramic mics (D104 in my case) with my Icom 735 Transceiver. The power for the circuit is supplied on the audio line as in electret mics. The results have been very good - Best audio reports ever with a properly matched D104. The unit was built in a large IF can with a mic jack (stereo phone type) on one end and a PCB cover on the other - using ugly construction techniques.



WANTED: Circuit Diagram/Manual on MARCONI 52 SET (Canadian) Loan/Return
Bill Watson, G4EHT, 12 Chadswell Heights, Lichfield. Staffs.

WANTED: Circuit or Manual of CODAR AT5 TRANSMITTER for Loan and return
K.G.Attkins, G6CDD, 30 The Brow, Woodingdean, Brighton. Sussex.

■ 7Mhz D.C. Rx. using 74HC4066



■ OJ1ZB ■

ALL BAND VXO TRANSMITTER

John T Collins KN1H

Building and using simple QRP Transmitters is a lot of fun, but, swapping crystals and output filters in order to change bands, and having no VXO range on the low bands, made me wish the whole mess was in one box with a tuning knob. Thus was born the following All Band QRP Transmitter.

The frequency mixing scheme was inspired by the presence of all but one of the needed crystals in my junk box. Possibilities abound for other combinations, but it's recommended that the VXO be as high in frequency as practical to maximise swing. Spend a pleasant evening with your box of odd crystals and a calculator; you may be surprised at what you find!

Circuit Description

With L1 set at 9uH the VXO can be tuned with C1 from 17.065 Mhz down to 17.050 Mhz. With larger values of L1, the frequency can be pulled about 25 Mhz, but stability suffers at the LF end. L1 is actually a miniature 10.7 Mhz IF coil with the capacitor snipped out. There is no practical way to get a perfectly linear tuning range with this circuit, but an acceptable compromise can be had by using a straight line frequency (off center rotor) type of capacitor for C1.

The Heterodyne Oscillator is a Pierce circuit allowing virtually any type of crystal to be used. Crystal frequencies were selected to produce output in the hotbed of QRP activity on each band when mixed with the VXO output.

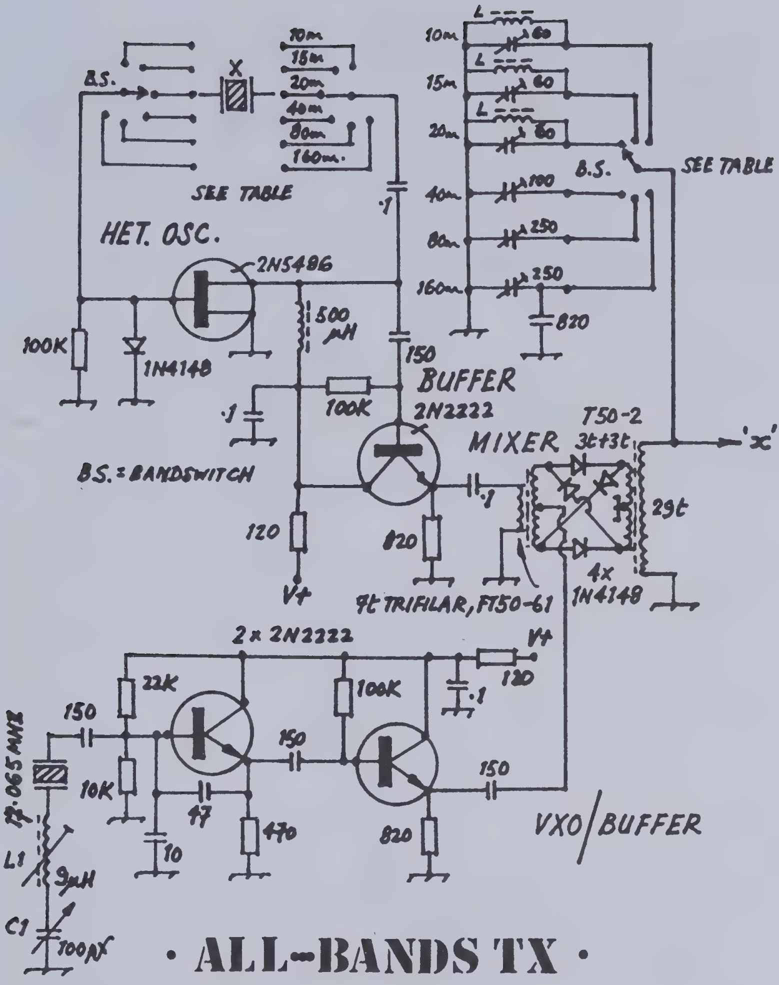
Both the Mixer and Driver circuits are based on ZL2BDB's 'Three Band Transceiver' series featured in Break in during the 1970s. The mixer input is a conventional broad band transformer, while the output is tuned to the desired frequency band. About 3V P-P at high impedance is available at G1 of the dual gate MOSFET driver, which, due to its own high input impedance, does not load the tuned circuits much. Drive to the pa is 40 - 50mw, depending on frequency, with Drain current set to 15ma. Adjusting the voltage at G2 will alter the Drain current and the gain of the stage, so some fiddling with the resistor values may be in order. The 800 ohm output impedance of the MOSFET is stepped down to about 10 ohms at the PA base through two 9:1 trifilar wound transformers. Ferrite beads were added to both G1 of the Driver and the base of the PA to cure a case of erratic behaviour, apparently caused by VHF parasitics. In the PA I started with a 2N3866 which worked fine, but 'went away' when the transmitter was accidentally keyed with no antenna connected. The 2N3137 in its place now seems to be more forgiving. Power output ranges from 700mw at 10M to 1.2W at 160M.

In the output are peaked low pass filters from a DJ1ZB design. They work better than conventional half wave filters at reducing the mixer product outputs that are below the desired frequency, as well as the harmonics that are above it.

TR switching is accomplished with a toggle switch which controls a small 12V relay for antenna changeover, and feeds 12V to the Het. Osc., keying circuit, and receiver mute input. The PA and VXO are always powered up. A momentary 'spot' switch is wrapped around the T R switch to apply 12V only to the Het. Osc. and receiver mute input. I have the bias on my homebrew receiver's mute circuit adjusted such that there is enough audio output for netting a station to frequency with this arrangement.

It was found to be convenient to mount all of the crystals, tuned circuits, and LPFs on the bandswitch, with the active components 'sky_wired' on a piece of unetched circuit board. The bandswitch itself is 5 1P 12T wafers, leaving room for up to six additional bands with the installation of a crystal, tuned circuit, and LPF for each band.

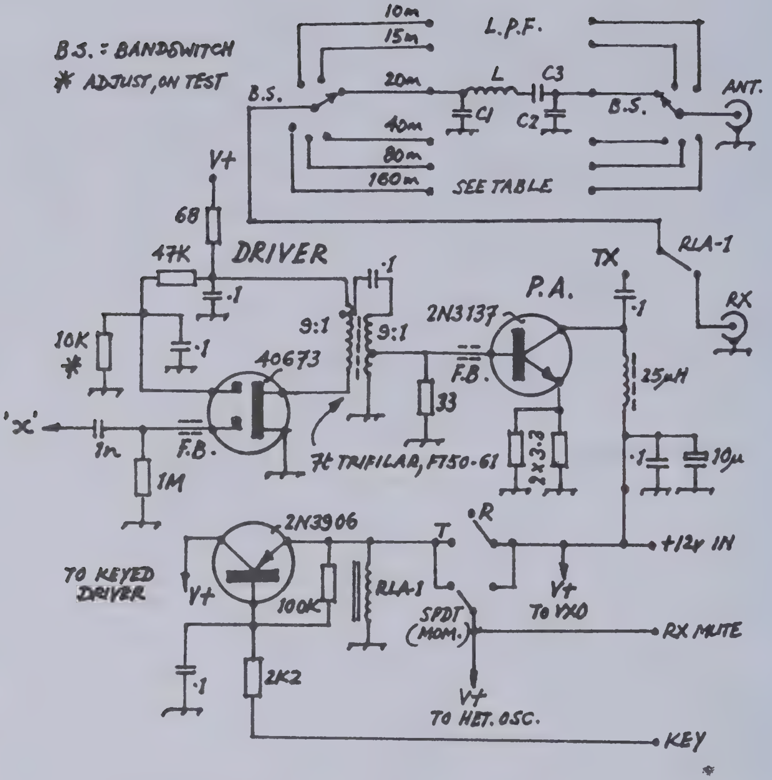
To date over 50 QSOs are in the log using this transmitter with a companion homebrewed receiver, including WAC on 10M which was quite gratifying. It's a real pleasure to change bands at a twist of the knob, and to have 15Khz tuning range even on 160M!



· ALL-BANDS TX ·

KN1H ~ J. T. COLLINS ~ 2822

160 m USERS: Dick Pascoe, GoBPS has had several interesting comments following his note in the last issue. George, G3KXP, has managed to work some nice EU countries and sent a copy of 160m from suburban sites, circa 1973 : an interesting article.
John, KN1H uses an Argosy converted to 160 and is close on WAS. He uses a G5RV at 65ft with strapped feeders and 4 elevated radials as counterpoise and seen a 3dB increase in antenna current! (135ft long if you can fit them in!) Send any 160 info via KANGA.



BAND CHANGE COMPONENTS

		Mixer Tuning		Low Pass Filters				
Band	XTAL	L	C	C1pF	C2pF	C3pF	LuH	Turns on T 50 2 Core
10	11 MHz	1uH	60pF	71	127	39	1.07	15
15	4 MHz	1.5uH	60pF	92	168	51	1.42	17
20	3 MHz	3.9uH	60pF	143	250	78	2.16	21
40	10.02 MHz		100pF	280	510	150	4.3	29
80	13.5 MHz		250pF	560	1000	300	8.5	41
160	15.25 MHz		250pF +820pF	1060	1900	590	16.1	57

G FILTERS
Roy Lewallen W7EL

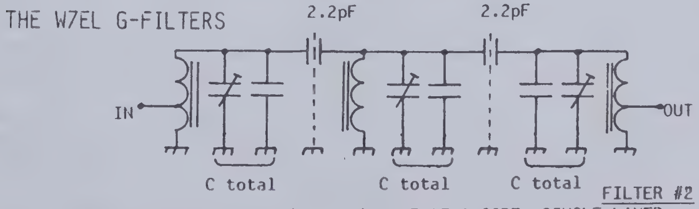
From my Oregon QTH, only one SWBC station has been strong enough to break through my little 40 meter "optimised" rig's direct conversion receiver. The station, located in San Francisco, gets through only very occasionally when propagation is exceptional. What I heard with the rig in England was another story! Several SWBC stations were constantly in the background. Since the mixer in the "optimized" rig is as immune to thie interference as any I've found, the only solution is to filter the stuff out before it gets to the mixer.

Two filters were designed with the help of LADPAC, a program written and kindly furnished to me by Wes Hayward, W7ZOI (LADPAC is commercialy available.) Prototypes of the filters were built and tested and performed remarkably like the computer model.

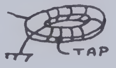
PERFORMANCE

G filter No.1 has a 3 dB bandwidth of about 100 kHz, chosen so that it would be relatively flat from 7.0 - 7.05 MHz. The insertion loss is 6.8 dB. G filter No.2 has a bandwidth of about 78 kHz. Its insertion loss is 9.3 dB.. Most receivers have enough gain to permit this amount of loss; if not, extra audio gain must be added. The noise figure of nearly all receivers is good enough that the insertion loss won't noticeably affect receiver noise. G filter No. 1 is simpler and has less insertion loss, but No.2 has substantially greater attenuation in the SWBC band.

Freq	Response, dB	
MHz	No.1	No.2
6.9	-18.3	-32.4
7.0	- 7.4	-10.9
7.025	- 6.8	- 9.3
7.05	- 7.2	- 9.9
7.1	-11.3	-18.0
7.2	-21.7	-35.8
7.3	-28.7	-46.4



ALL INDUCTORS: 22t. 30 swg (28 AWG) on T 37 2 CORE, SINGLE LAYER
TAP AT 2t. FROM COLD END.
C total : about 270pF.



CONSTRUCTION

The inductors must be duplicated exactly to achieve the same performance as the prototypes. Make the winding in a single layer, with turns evenly spaced. Don't coat the core with Q dope or any other material. Using wire a size or two smaller or larger probably won't have much effect. For the capacitors shown as variable, the best approach is to use as much fixed capacitance as possible, with a variable to make up the remainder. Mica, ceramic, or most types of plastic are ok for the variable, but I came across some subminiature plastic units that greatly increased the insertion loss of a 28 MHz filter, so use with care. For fixed capacitors use mica, polystyrene, or ceramic. It's a good idea to put shields between sections, but the filter may work adquately without them.

USE

These filters will work properly only with 50 ohm impedances at both ends. Connect the filter between the transmatch and receiver (not transceiver), or the antenna and receiver if a transmatch isn't used. In a transceiver, it must be connected on the receiver side of the T R switch. For rigs like the "optimized" transceiver which have a diode ring mixer and no rf amplifier, connect the filter at the input of the mixer. DON'T TRANSMIT THROUGH THESE FILTERS!
To adjust the filter, simply tune all capacitors for maximum signal at 7.025 MHz. Any other 50 kHz segment in the 40 meter band can be covered if desired.

If you use one of these filters, please drop me a line and let me know how it worked. I can't test them here under the same conditions encountered in the UK and Europe. It's possible to modify the design in several ways to optimize performance (for example, lower insertion loss can be achieved at the expense of using larger cores; sharper cutoffs are possible with more sections). Let's work together to make 40 meter direct conversion receivers as useful on the other side of the pond as they are on this side.

YEOVIL QRP CONVENTION YEOVIL QRP CONVENTION YEOVIL QRP CONVENTION 1989
SUNDAY, MAY 7th from 9am, PRESTON CENTRE, MONKS DALE, YEOVIL.
Lectures, Traders, Food and Drink.
Details: Dave Bailey, G1MWM, 7 Thatcham Close, Yeovil, BA21 3BS.

PRE QRP CONVENTION KEY-BASH

A QRP "FUN RUN" the week preceding the Yeovil QRP Convention.

CALLS	GB2LOW from the Yeovil Club's HQ	G-QRP No. 4248
	G3GC, QTHR	G-QRP No. 3158
	G3CQR, QTHR	G-QRP No. 2813

WHEN	At any time between 2100 GMT on Friday 28th April to 2300 GMT on Friday 5th May 1989
FREQS	3560 KHz and 7030 KHz +/- 10 KHz
RULES	Contacts must be between QRP stations. Any of the three FUN RUN calls listed above must be worked first to start scoring on each band.
SCORING	Contacts with G3GC and G3CQR will be worth 20 points and with GB2LOW 50 points. After working a starter "Fun Run" station each QRP QSO will score 5 points until a second "Fun Run" station is worked and then each QRP QSO is worth 10 points. After working the third "Fun Run" station each QRP QSO is worth 15 points. e.g. G3GC =20 points thereafter QRP contacts 5 points each, G3CQR 20 points then QRP contacts 10 points each, GB2LOW 50 points QRP contacts then 15 points each. This rule applies individually to each band. The overall score is the addition of the two band scores.
EXCHANGE	RST, Power Output, QTH, Name and G-QRP Number
ENTRY	Separately list for each band all the call signs, commencing first with a FUN RUN station, together with the information in the "EXCHANGE" and points claimed. Bring your entry with you to the Convention on Sunday 7th May. Awards will be made at the Convention for the highest score on each band and for the best total score. If you are not fortunate enough to attend the Convention, then send your entry to G3CQR, QTH-R, to arrive not later than 31st May to qualify for the separate postal award. Working GB2LOW operating at the Convention on Sunday 7th May will score an extra 50 points.

Have fun and we will do our best to be on the air as much as possible from all three FUN RUN stations.

THE "SUDDEN" RECEIVER

George Dobbs G3RJV

A Simple Direct Conversion Receiver
For Any Single Band from 160 - 20M
Using Commercial Coils with available Kit or PCB

For several years club members have been asking for a G QRP Club simple receiver project and I had been half heartedly investigating the possibilities. Then on our visit to Dayton I met John Westphal, W8YNA. John, an avid constuctor, introduced me to the NE602 and some of the circuits which had appeared using this IC in the USA ; he also provided me with samples. Amongst the circuits was a simple QST design called the Neophyte and this approached seemed to offer a possible solution to the request for a simple club receiver project.

The NE602 is a useful device : being a double balanced mixer, a voltage regulator and an HF oscillator all contained in one 8 pin DIL package. The Oscillator is capable of working to about 200MHz and the access to the IC allows for several VFO configurations. That adds up to about three quarters of a direct conversion receiver in one chip ... very handy!

I tried several designs, including the Neophyte and the device seemed to work well. The problem with the Neophyte was its use of balanced input and outputs which made the use of commercial coils more difficult. The circuit described here was originally hooked up on the bench to see the practical disadvantages of using the mixer single ended. The results were very pleasing for such a simple circuit. The mixer worked well and the VFO, which might be recognised as the popular Colpitts configuration, was remarkably stable. I build 80 and 40m versions and shared the circuit with G3ROO, who quickly came up with the LC values for 160/30/20m versions all using standard Toko Coils.

The receiver uses a fixed tune input filter, from an RF attenuator, control feeding the mixer. The oscillator circuit (around pins 6/7) uses another Toko coil and is calculated for the cheap 10/10/20pF three gang capacitors sold by John Birkett. The band values chart shows the required LC values for each band including the use of this variable capacitor. Naturally other variable capacitors of similar value could be used.

The audio gain is provided by an LM386 8 pin DIL IC. There is plenty of available audio for driving walkman type headphones but hardly enough for good loudspeaker volume. The receiver is supplied by a 9 volt battery : A 12 VOLT SUPPLY MUST NOT BE USED.

The receiver fits easily onto a 2" x 2" printed circuit board. The copper layout and component layout are shown. Our prepared boards have been increased in size to allow the mounting of the three gang variable capacitor described above. However the board is marked for a saw cut to reduce it to the 2" x 2" size for mounting a capacitor off board.

Choice of components is non critical except for the capacitors C4/5/6 and capacitor across VC1, which should be polystyrene. I used miniature ceramic plate types for C1/2/3 and the rest are miniature discs and electrolytics. All resistors are quarter watt. The 1K attenuator control is a carbon track linear potentiometer of any value from around 50 ohms to 2.2K. The audio gain control is a log. pot. of 4.7K or 10K. During construction, it is helpful to build the audio section first (audio gain control to output) and test this section before completing the rest of the circuitry.

The only adjustments required are getting the oscillator onto frequency, using the core in T3 and peaking the input filter using the cores in T1/2. A counter can be connected to the unused winding on T3 but I found that this gave unreliable readings on my counter. The best, and simplest way, to adjust the oscillator is to tune a receiver to the required band and use a few feet of wire as an antenna, draped across the body of the NE602. The core on T3 is adjusted (slowly!) until the signal is heard in the receiver. The bottom end of the band may be set with VC1 fully meshed. Secure the core with "goo" : I like bees wax.

Connect an antenna or a signal generator and peak T1/2 for maximum signal strength. I suggest several "peak ups" in the order: centre of band, high end, low end and back again to centre for final peaking.

The receiver is simple but it works surprising well. The RF attenuator may be essential in the evenings to reduce BC breakthrough. A recommended way to use the two gain controls is to have the audio control set high and to use the RF control as the effective gain control.

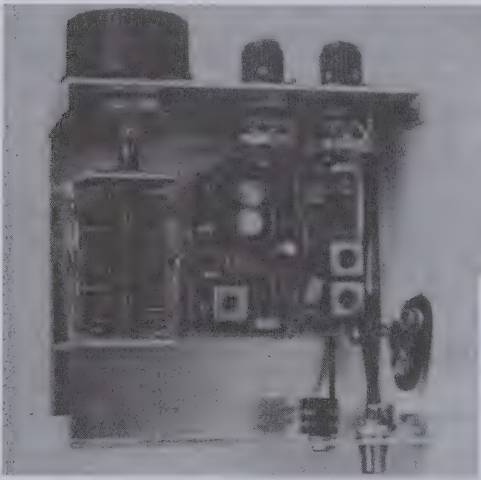
Build it...I think you will enjoy this little receiver.. Why "SUDDEN" ? Well, that's G3ROO's idea. When I am not building up QRP equipment (or for that matter when I am!) I am the Vicar of Sudden, once a village until it was swallowed by the town of Rochdale.

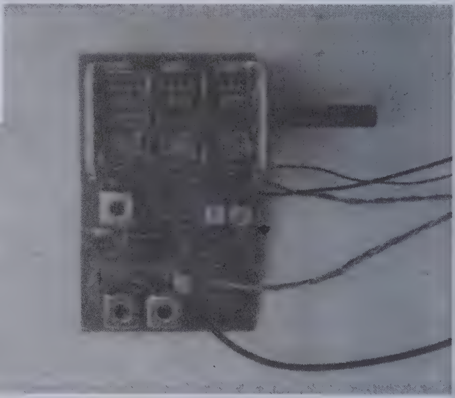
SUDDEN RECEIVER PRINTED CIRCUIT BOARDS : £1.00
NE602 ICs (a few available) : £2.25
Available from Dave Aizlewood, G4WZV, 36 King Street. Winterton, Scunthorpe, South Humberside, DN15 9TP. (Cheques: G QRP CLUB, please add 20p postage)

COMPLETE SUDDEN RECEIVER KITS including coils for 80m, variable capacitor etc. are available from KANGA PRODUCTS for £13.95 : see advert in this issue.

PROTOTYPE SUDDEN RECEIVER

BUILT FOR 80 METRES.



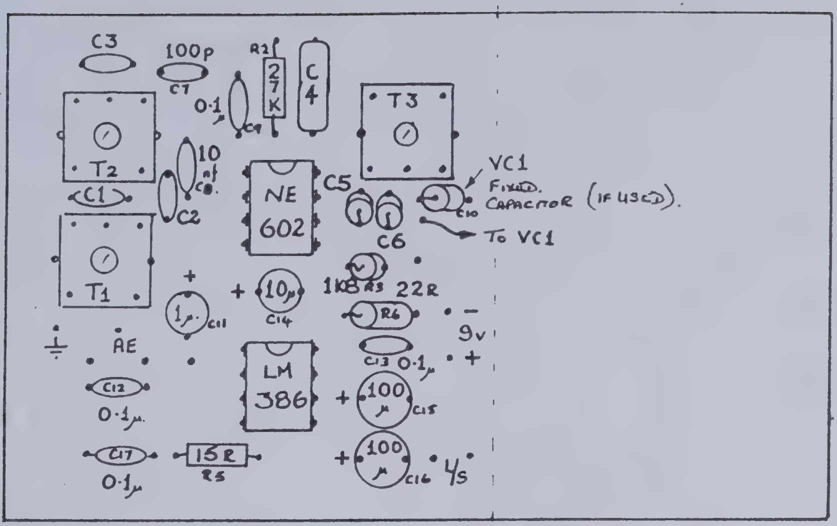


THE SUDDEN RECEIVER BOARD

KANGA KIT VERSION

COMING SOON:

The "LCK" Receiver/Transceiver for 160 or 80m. A simple but good performance suphet design using NE602 ICs and a ladder filter. See Next Issue.


C3
100p
C7
R2
27K
C4
0·1µ
C9
T3
T2
10nf
C8
C1
C2
NE 602
C5
VC1
Fixed. Capacitor (if used).
C10
To VC1
C6
T1
+
10µ
C14
1K8
R3
22R
R6
1µ
C11
-
9v
+
AE
C13
0·1µ
LM 386
C12
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+
100µ
C15
+
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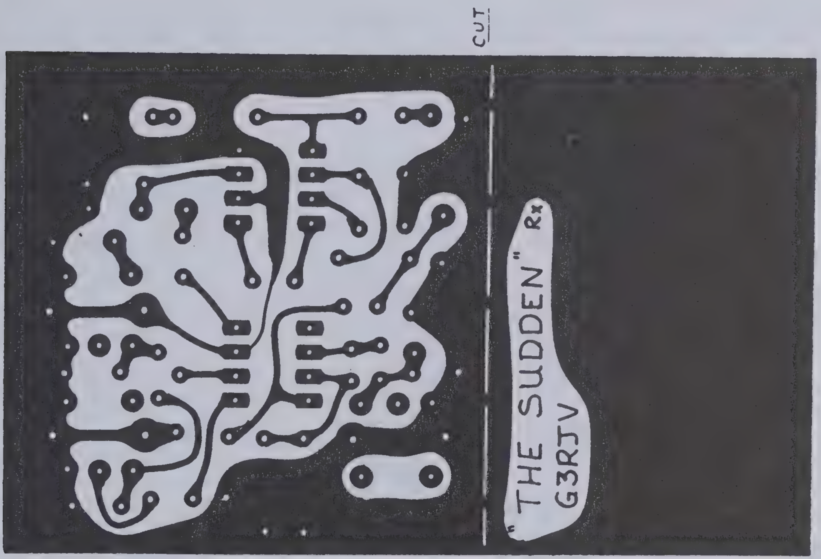
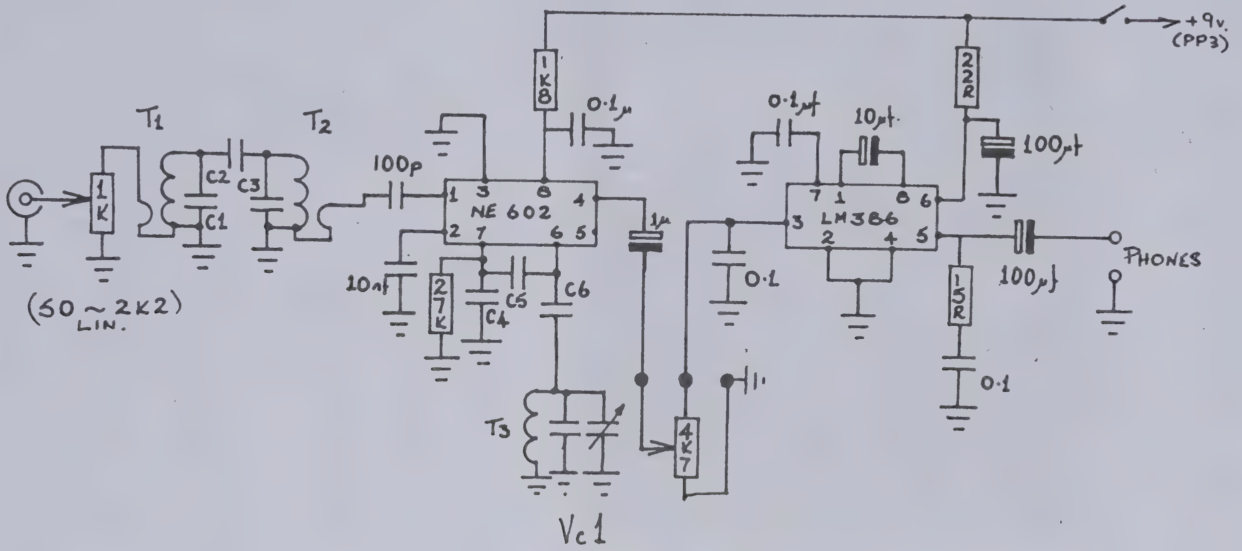
C17
0·1µ
15R
R5

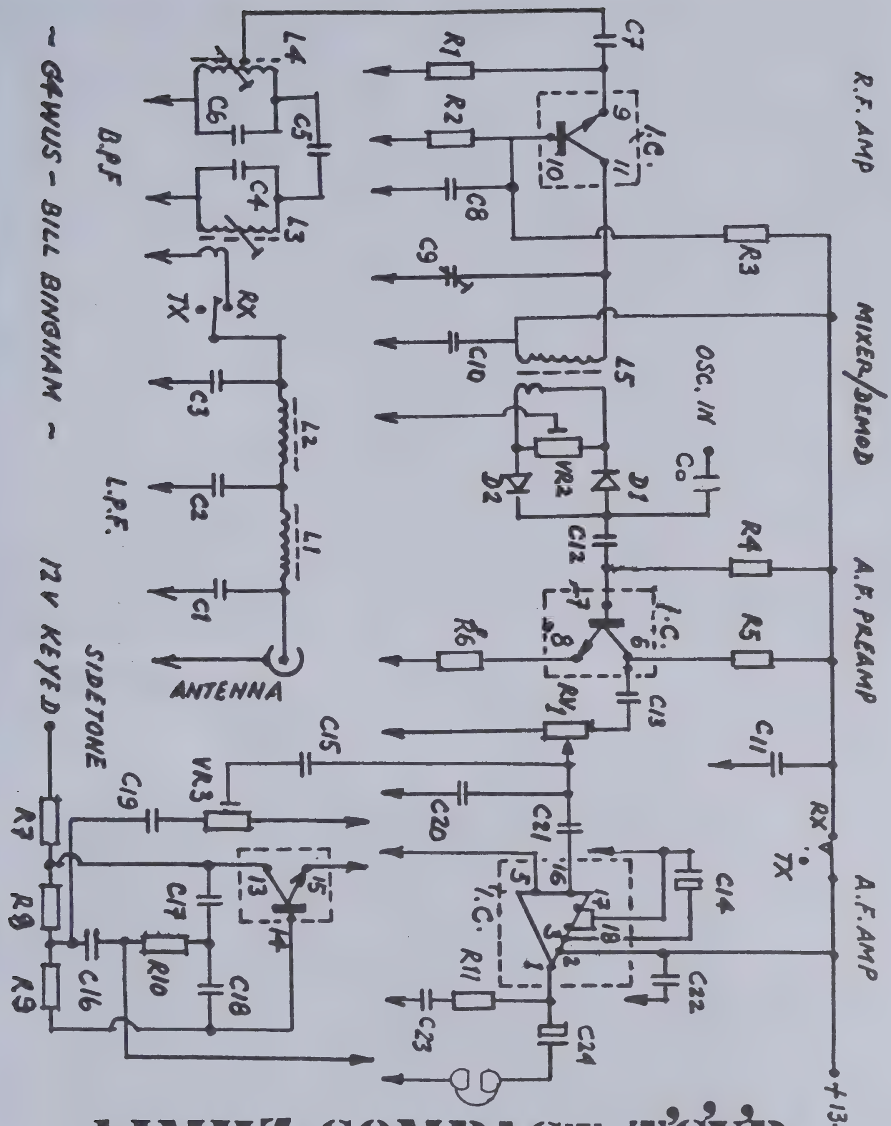

CUT
"THE SUDDEN" Rx
G3RJV

The SUDDEN Receiver

G3RJV

BAND	C1	C2	C3	T1	T2	Vc1 (BIRKETT) +C10	C4	C5	C6	T3
160	220	10	220	3333	3333	100pf ALL SECTION +	1nf	1nf	560	3333
80	47	3	47	3333	3333	100pf+ ALL SECTIONS	1nf	1nf	560	3334
40	100	8p2	100	3334	3334	1 SECTION + 47p	560	560	270	KXNK 4173A0
30	47	3	47	3334	3334	1 SECTION + 68p	680	680	220	3335
20	100	3	100	3335	3335	1 SECTION + 68p	220	220	68	3335





14MHZ COMPACT T'CVR.

PARTS LIST

Semiconductors	
D1, D2	IN 4148 matched pair
IC1	LM389N
TR1	BC107
TR2	2N4427
TR3	BCY70

Inductors	
L1, L2	12 Turns 22 swg on T-50-2
L3*	14 Turns 26 swg, Link winding 4 Turns
L4*	14 Turns 26 swg, tapped at 10 turns L3/4 on 4.8mm former + core
L5	20 Turns 22swg on T-50-2, 2 turn link over cold end
L6	10 turns 32 swg on ferrite bead.

NOTE: L3 and L4 on the PCB are Toko 3335 coils with C4/6 = 100p and C5 = 3p

XC1	14.060 fundamental

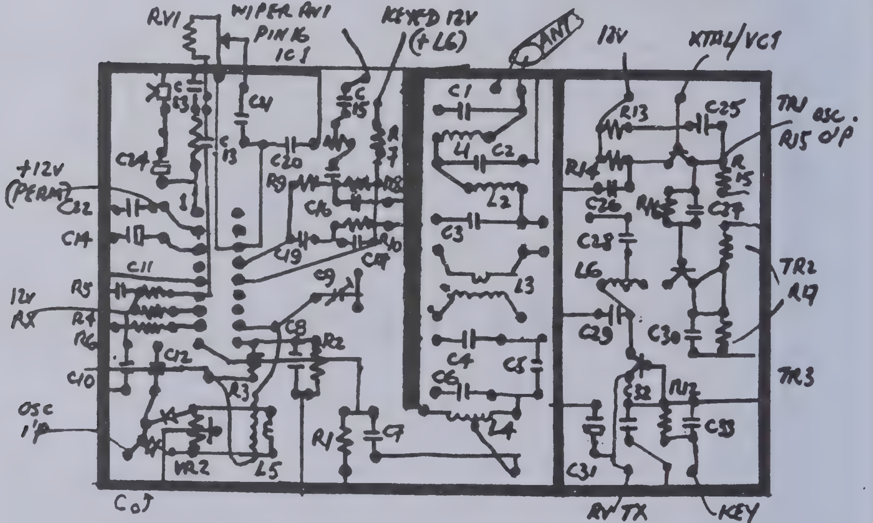
Resistors	1/4w 5% carbon film
2R2	R11
39R	R17 adjustable
100R	R14
150R	R6 adjust for gain (or short)
1K	R12, R15, R16
2K7	R1
4K7	R10
10K	R5, R7
18K	R2, R8, R9
33K	R13
100K	R3
5M6	R4
VR1	22K Lin.
VR2	1K Preset
VR3	4K7 "

Capacitors	Polystyrene
10pF	C5
100pF	C4, C6, C25, C27
220pF	C1, C3
360pF	C2
	Ceramic Plate
10nF	C7, C8, C15-C21, C26-C30
	Polyester
10nF	C23
0.1uF	C10-C13, C22, C32. C33
	Electrolytic, 25v p.c. mountin
10uF	C14
47uF	C31
100uF	C24
100pF Trimmer	C9
100pF Variable	VC1

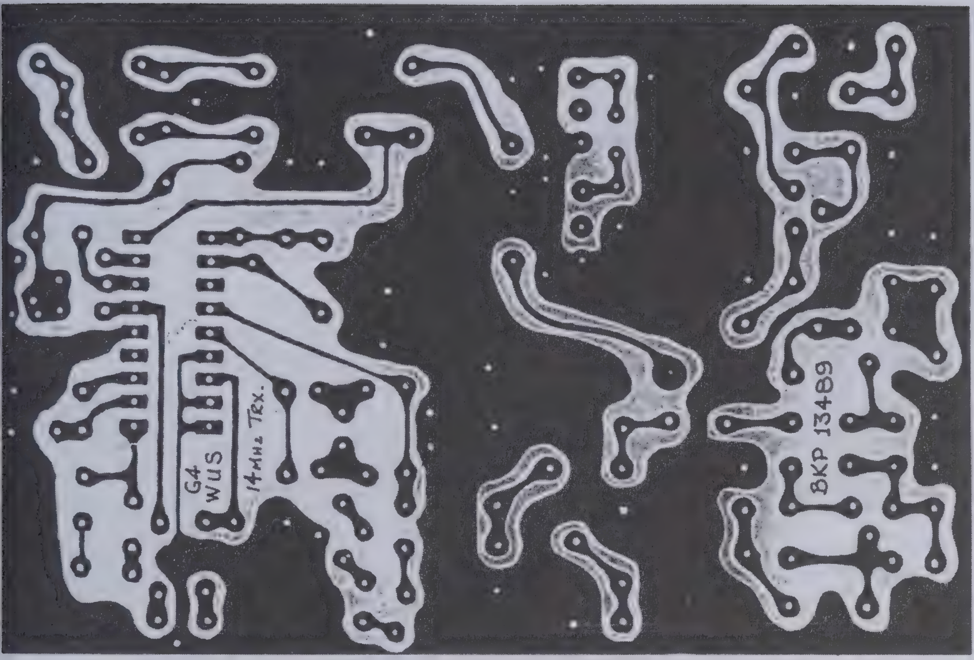
Miscellaneous
Phone sockets
3.5mm Jack plug sockets
Switch SPCO (on/off)
Switch DPCO (12vRX/TX & Ant Changeover)
PCB 110mm x 75 mm

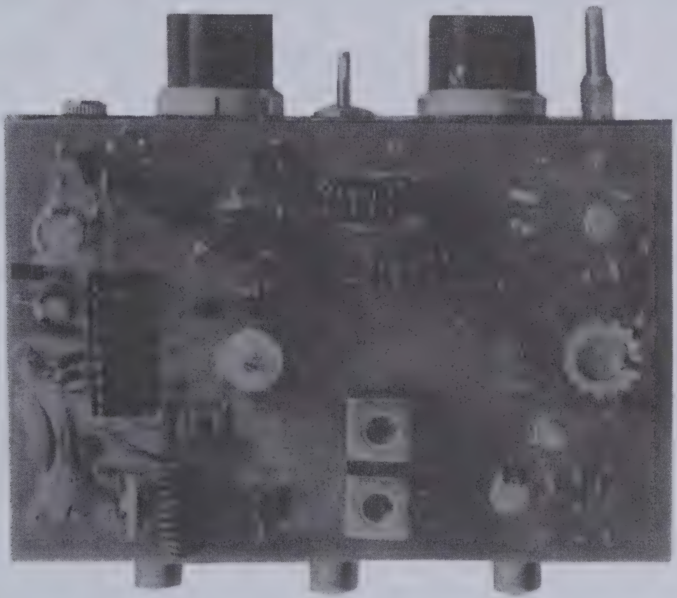
NOTE: Co, 0.1, or less (adjust on test) is mounted under the PCB as shown.

G4WUS "COMPACT"



COMPONENT LAYOUT





PRINTED CIRCUIT BOARDS FOR "THE COMPACT" ARE AVAILABLE AT £2.00 (20p Postage) from: Dave Aizlewood, G4WZV, 36 King St. Winterton, Scunthorpe, DN15 9TP. Please make out cheques to "G QRP CLUB"

COMPACT 14 MHz TRANSCEIVER

Bill Bingham G4WUS

The rig came about when I saw the LM389N IC in a radio that I was trying to mend. It looked quite a useful device so some were purchased from Farnell (or Maplin - under £ 2.00).

As you can see from the circuit diagram there are 3 VHF transistors and one audio amp all in this chip. One transistor was to be used as a RF amp, one as a audio pre-amp and one as a sidetone oscillator. All the filters were included because the RF amp, being bi-polar, is more prone to break-through, so I decided to give it as best a chance possible.

The audio amp side was a bit tricky at first and was finally cured by de-coupling capacitors, it could perhaps be improved further.

The TX is an 'OXO' which is already documented in SPRAT and GQRP handbook.

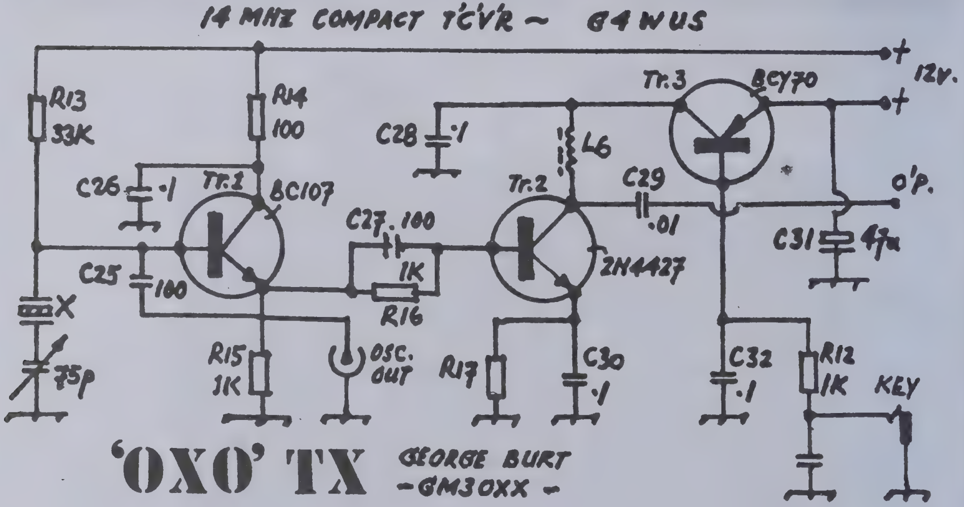
Sidetone and RX bandpass filters circuits came from the PW TEME.

Antenna and 12v RX/TX change over is by DPCO switch.

I am fortunate to have a Marconi Radiotelephone test set (TF2952) and with this I could still hear RF at 0.5uV and the output power of my rig was 600mW.

My first QSO was with a UC2 who rubber stamped me, my second was a 2XQRP QSO with IT9 (with QRM from ZS and W - Hi!)

I hope it works OK!

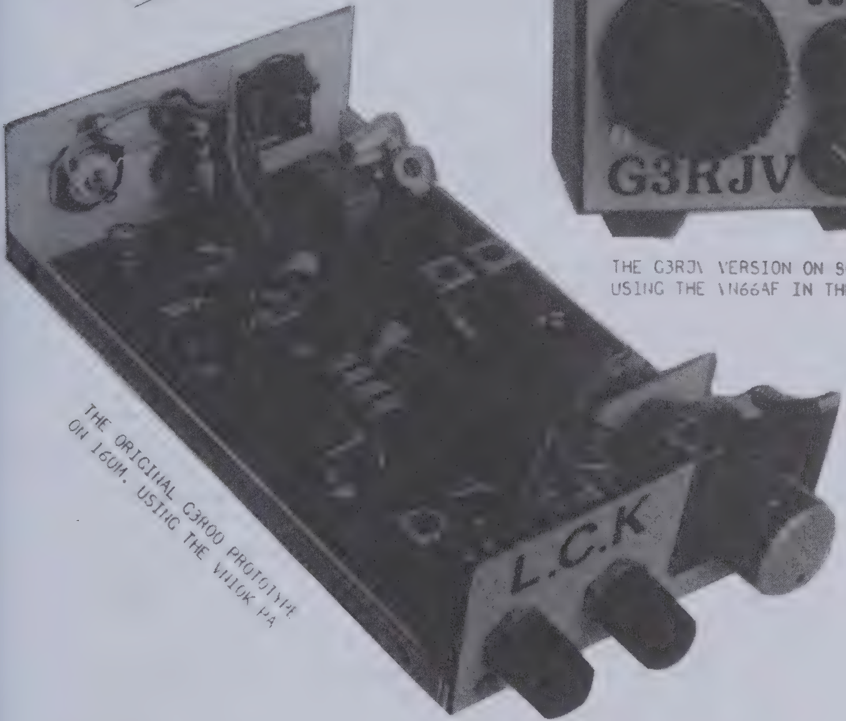


EUCW NEWS....
It is with sadness that we report the death of Eduard Schnell, DL6MK. Ed was the Chairman of EUCW before Tony, G4FAI, and also President of the High Speed Club of Gremany and organised the World High Speed Telegraphy Championships to be held in Hanover in November. Ed made a large and valuable contribution to international morse telegraphy and was very active on the 3.5MHz band. Angie, G0HGA, the G QRP ECM for EUCW has sent condolences on behalf of the club.

THE LCK TRANSCEIVER

A SIMPLE QRP SUPERHET TRANSCEIVER

THE G3RJV VERSION ON 80M
USING THE VN66AF IN THE PA



THE ORIGINAL G3ROO PROTOTYPE
ON 160M. USING THE VN10K PA

RECEIVER:
10dB S/N for 0.5uV
Low Power Drain: 15 mA

TRANSMITTER
3 watts (or more) RF Output
Built in change over and LPF

A COMPACT EASY TO BUILD SUPERHET CW TRANSCEIVER FOR A SINGLE BAND (WITH A KIT)

THE RECEIVER:
A discussion between G3ROO and G3RJV at Christmas over the SUDDEN receiver, the availability of some 4.605MHz computer(?) crystals, a few prototype boards and the LCK receiver came into being. A simple four pole ladder filter worked very well (single sided and wide enough for ssb reception) and the overall performance of the receiver was better than expected.

The drawback with the filter was that the crystal could not be moved far enough for ssb reception but it is ideal for cw work. It was found that using the 2KHz passband figure (see chart) increasing the termination resistor from 2K2 to 100K gives a better peak on cw : worth a try. One alternative, should ssb reception be required, is to change the filter to 9MHz (see chart) and use bfo crystals on 8998.5 and 9001.5.

The receiver information is given for 160 or 80m to match the transmitter board. Although G3RJV has run the receiver very successfully on 20m, some re-design of the transmitter would be required to give enough output on the higher bands. The input filter and first mixer are identical to that of the SUDDEN but feeding into the ladder filter on 4.608MHz. The oscillator is set on the high side (8.108 - 8.208 for 80m). A single dual gate MOSFET stage provides post filter amplification, one gate of this device could be used to add a suitable AGC circuit but in the LCK it is used to mute the receiver on transmit. The second mixer and bfo are another NE602 and an LM386 provides more than enough audio to drive headphones.

The insert circuit on the Receiver circuit diagram shows the FET buffer amplifier used to provide an output to drive the transmitter board. This need not be added if only the receiver is being constructed

THE TRANSMITTER

The VFO signal from the receiver board is fed via an emitter follower to yet another NE602 where it is mixed with a 4.608MHz crystal then through a trifilar wound transformer to a bandpass filter (T2/T3). The driver stages, of beloved circuitry, feed a single VN66AF VMOS FET. In the original 160m version a VN10K was used to give about 1.5w output, the VN66AF gives over 3 watts out on the later 80m version. The bifilar wound load choke in the VN66AF should be replaced with a single 7-10 turn winding if the VN10 device is used. The ouput from the PA passes through a simple 5 element low pass filter prior to being switched by the antenna relay.

The key controls two circuits. The hang circuit energises the relay, switching the antenna from transmit to receive and also supplies 12 volts to the transmitter circuits. This is held on by the hang circuit for a time (between a few milliseconds and half a second) determined by VR2. The amplifier and PA are keyed from the BC214 keying transistor. The receiver is muted using 12 volts from the transmit board applied to the receiver muting circuit. This is shown as an insert drawing which is added to the AGC pin of the receiver. These components are not required for receive only and if added to the receiver board, the two small PCB track links marked "X" must be removed from the receiver board.

NOTE that the sidetone is provided by the signal from the transmit board being picked up on the muted receiver. A RIT will be described in the next issue of SPRAT.

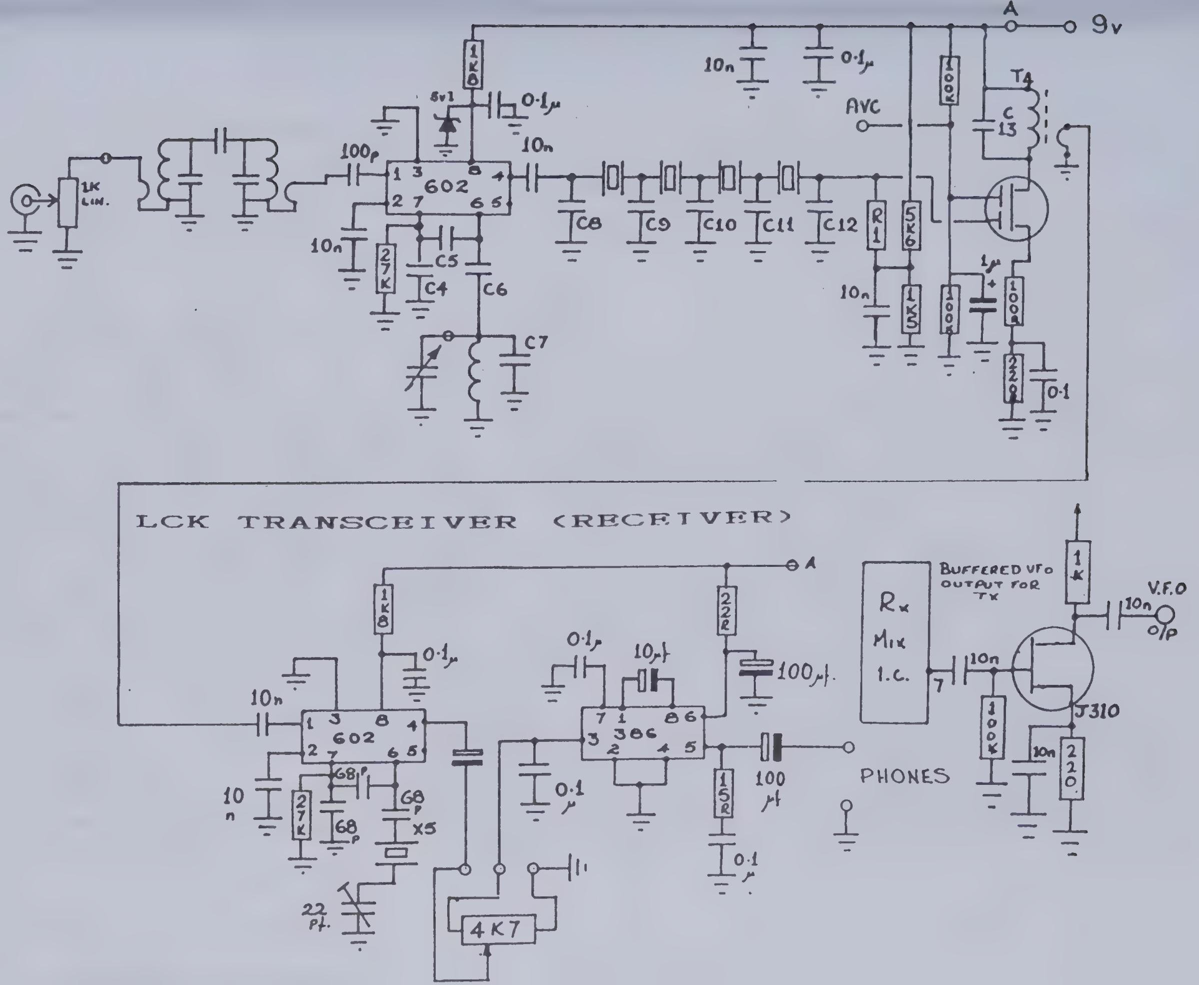
SETTING UP

The LCK Interconnections are shown between the transmit and receive boards. It good practice to join together AND GROUND all the crystal cans in the filter and to ground the other two crystal cans. The receiver setting up is quite simple and could be done, by ear, without test equipment, if the local oscillator frequency can be check either on a suitable receiver or a frequency counter. I like to start from the audio stages injecting a suitable signal and work back, peaking tuned stages along the way but it is quite possible to work from band signals to peak the IF can (T4), the input tuned circuits (T1/2) and adjust the bfo frequency with the 22pF trimmmer.

A predictable problem for some constructors will be the trifilar wound transformer (T1) in the transmitter. The dot indicates the START of a winding. Lightly twist the three wires, indentify the start and end of each wire, colour coded wire (supplied with Kanga kit) helps. Connect the start of one winding to the end of another winding. This gives a winding going round the core twice in the same direction with a centre tap. The ends of this winding connect to pins 4 and 5 of the NE602 and the centre tap to ground via a 10n (0.01uF) capacitor. the third winding drives the bandpass filter. The transformers T2/3 must be peaked for maximum output ofthe signal on the band.

Specimen voltages, taken from a prototype of the 80m version, are shown in the final diagrams, on the transmitter circuit these are shown in the "key down" state. Voltages on completed LCK boards should be within about 20% of these values.

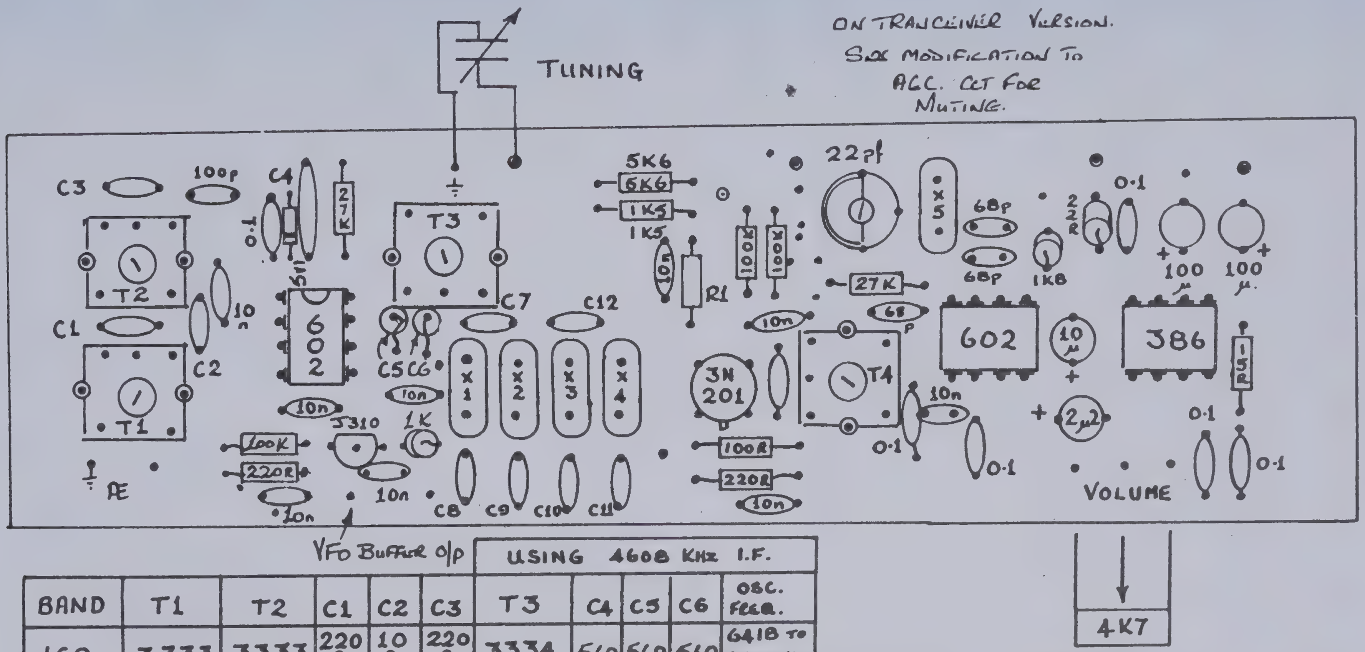
A KIT OF PARTS, COMPLETE WITH PCBs, IS AVILABLE FROM KANGA, 3 LIMES ROAD, FOLKESTONE, KENT. CT19 4AU. The Club members price is £58.00 (+#1 postage)
THE FIRST 50 KITS FOR CLUB MEMBERS ARE OFFERED AT #50.00.



LCK TRANSCEIVER (RECEIVER)

BASIC LCK RECEIVER LAYOUT

SEE ADDITIONAL DRAWINGS (2) TO INTERFACE WITH TX PCB
(MUTING AND VFO BUFFER)

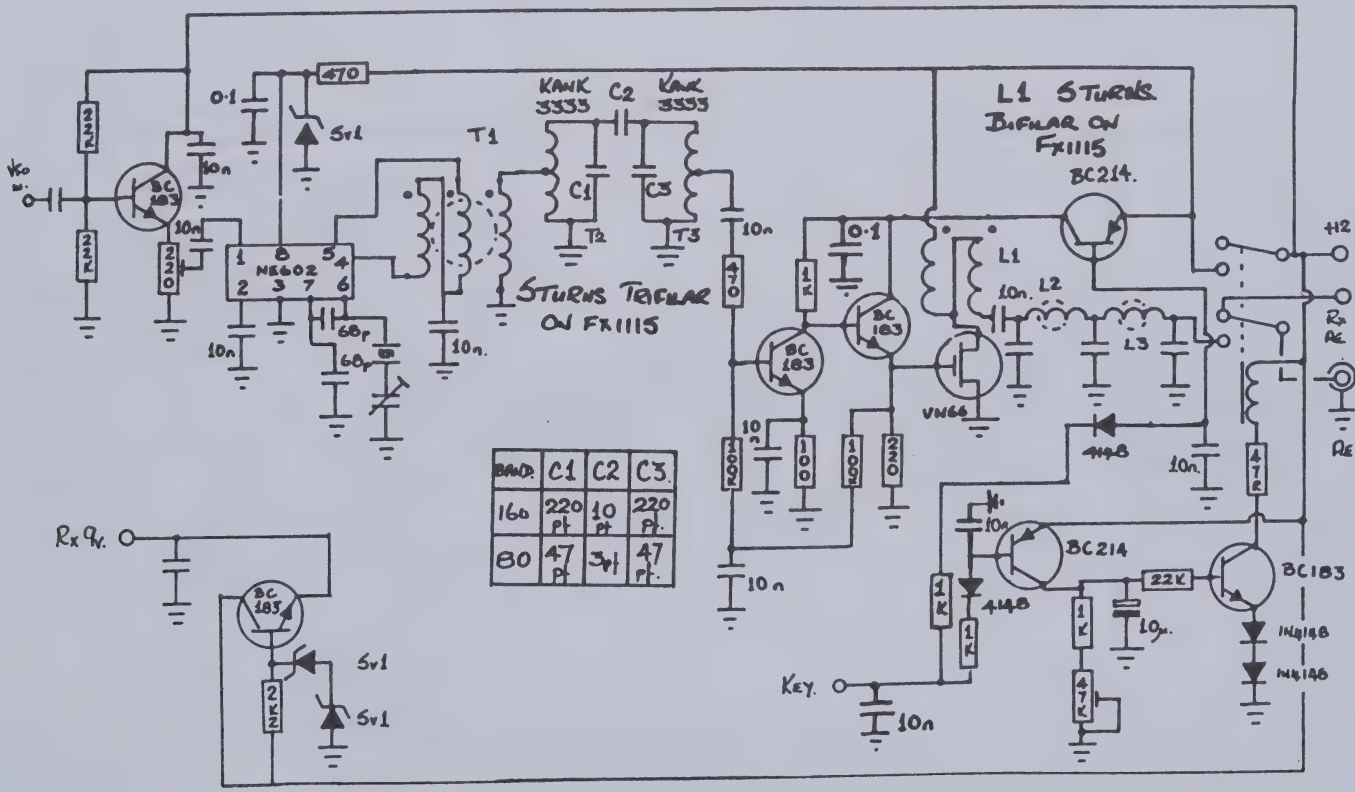


ON TRANCEIVER VERSION.
SEE MODIFICATION TO
AGC. CCT FOR
MUTING.

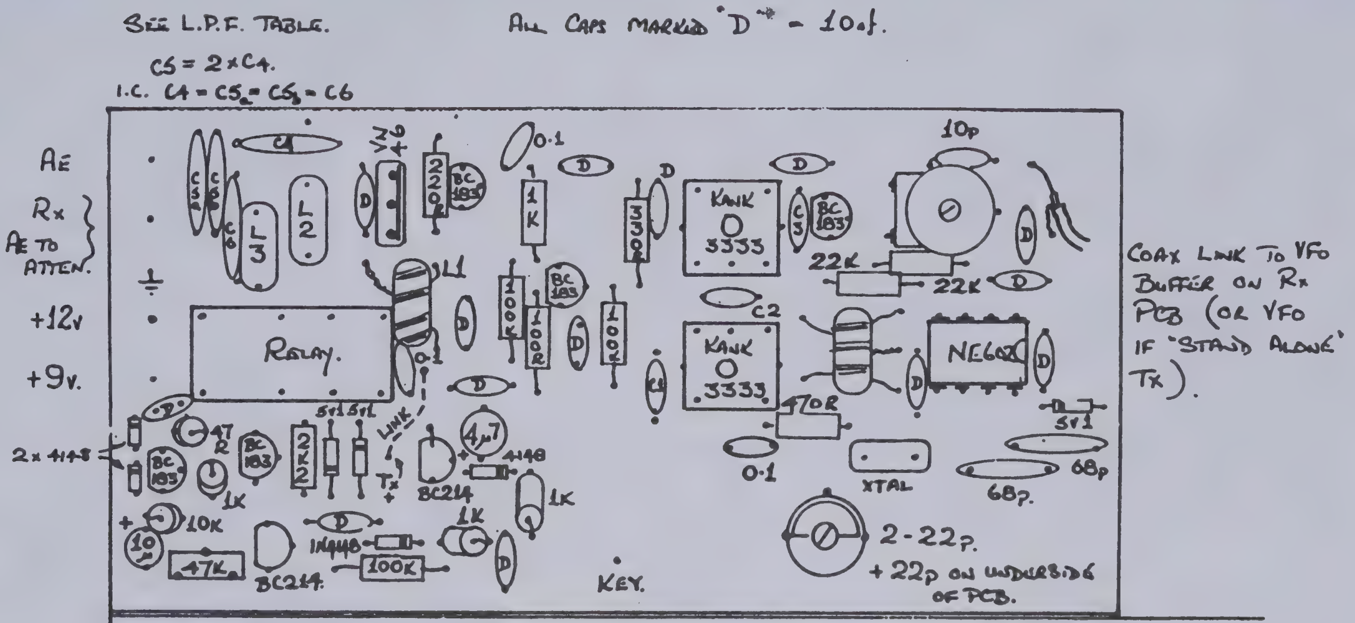
BAND	T1	T2	C1	C2	C3	USING 4608 KHz I.F.				
						T3	C4	C5	C6	OSC. FREQ.
160	3333	3333	220 p	10 p	220 p	3334	560	560	560	6418 To 6608 KHz
80	3333	3333	47 p	3 p	47 p	3334	680 p	680 p	220 p	8108 To 8408 KHz

	PICOFARADS						
CRYSTAL FREQ	C8	C9	C10	C11	C12	R1	PASS - BAND
4608K	18	33	47	33	18	2K2	2KHz
9,000K	8.5	37	57	37	8.5	1K	2KHz
4,608K	18	60	100	60	18	1K	1KHz

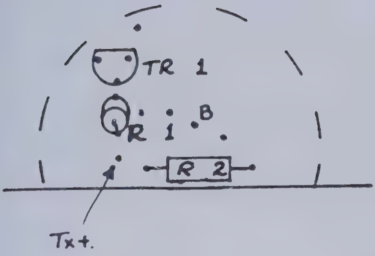
LCK TRANSCEIVER (TRANSMITTER)

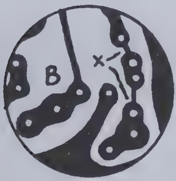


BAND.	C1	C2	C3.
160	220 pf	10 pf	220 pf.
80	47 pf	3pf	47 pf.

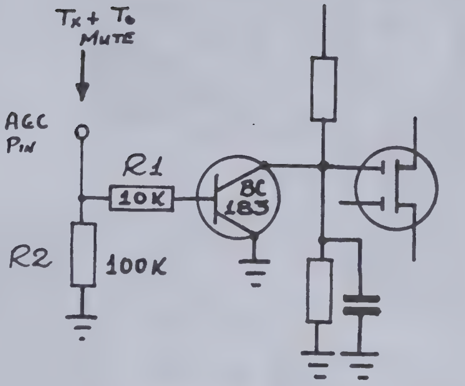


LCK TRANSMITTRR LAYOUT

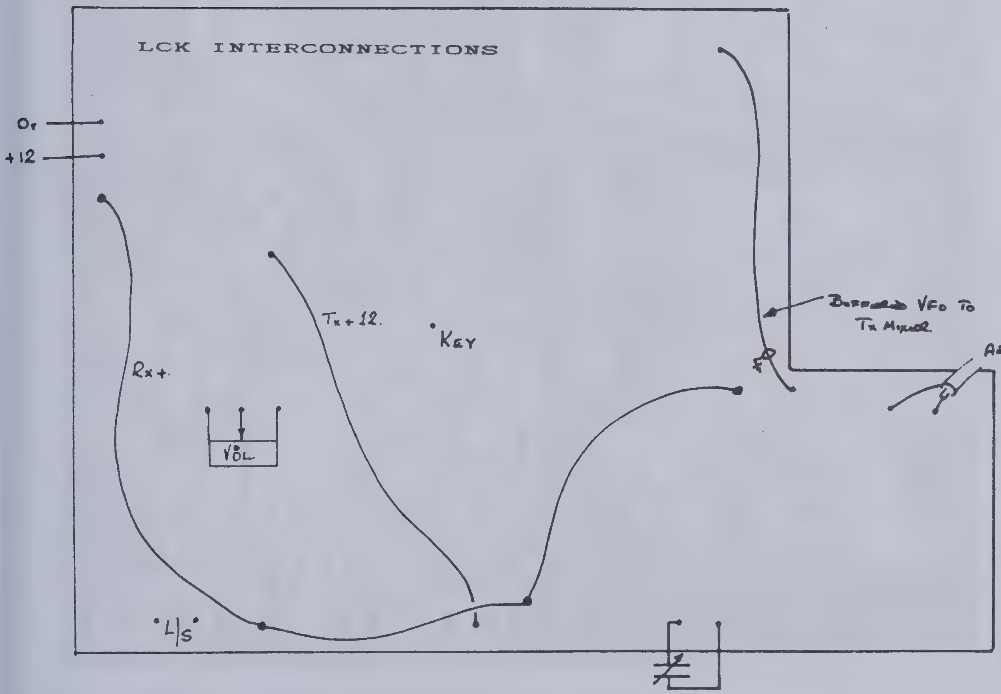




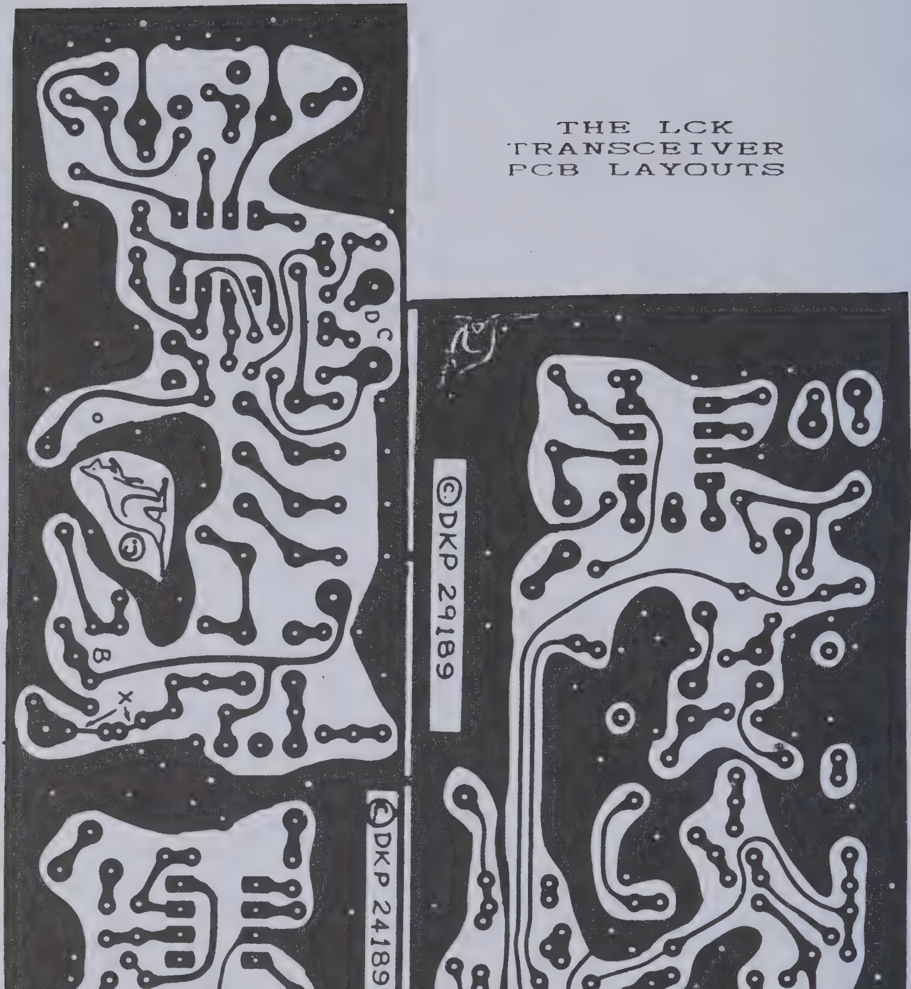
CUT TRACKS
"X"

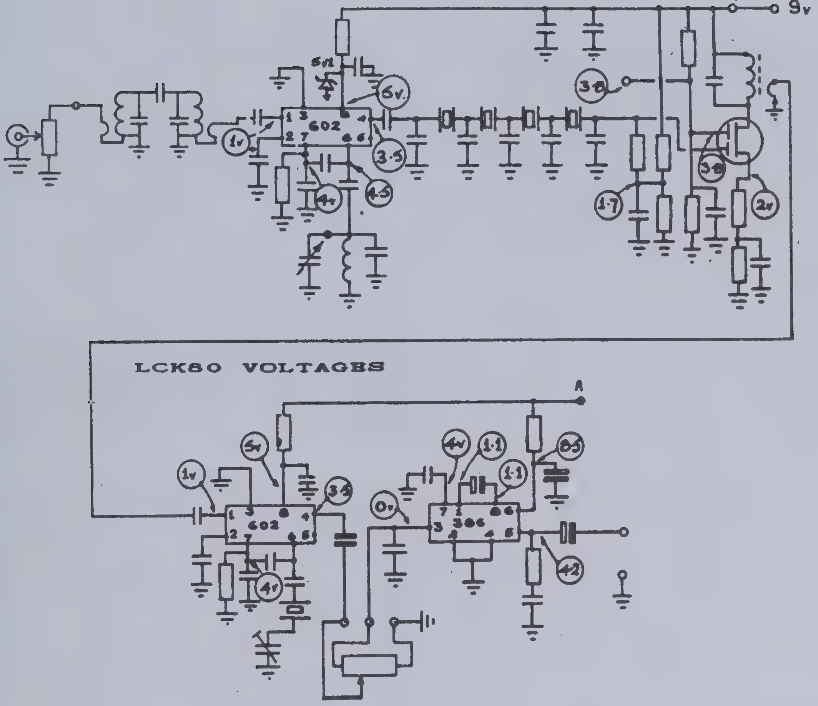


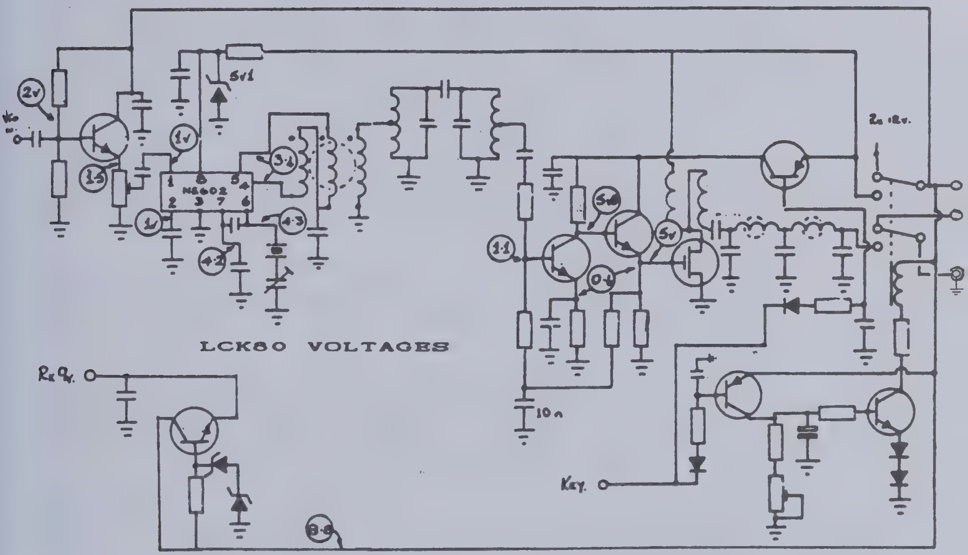
LCK RECEIVER MUTING
FOR TRANSCEIVE


LCK INTERCONNECTIONS

THE LCK TRANSCEIVER PCB LAYOUTS




LCK80 VOLTAGES


LCK80 VOLTAGES

THE WHITE ROSE RECEIVER JOHN HEY G3TDZ

The White Rose Receiver is half of an all band transceiver and is complete as a stand alone receiver.

The circuit was designed as a club construction project to allow those with minimum experience to get on the air or onto the new bands without breaking the bank or supporting the Japanese economy. Certain Class B members saw no point in struggling with the morse test only to be faced with a financial brickwall. Here then is presented a circuit which can be put together for about £25 excluding chassis and case, needs no sophisticated alignment equipment, and yet performs well.

The Circuit

A direct conversion receiver overcomes the necessity of expensive filters and difficult alignment: its shortcoming are mainly overcome by choice of design yet inexpensively contrived.

It was difficult to imagine inexperienced constructors tackling huge coil packs, plus the fact the whole range from 160m to 2m was envisaged. The tunable IF approach was adopted, tuning 6 - 6.5MHz with plug in converters for the various bands. Most operators have favourite bands; other bands may therefore be added at a later date where desired as finances permit.

The choice of 6MHz allows good image rejection, but more interestingly the crystals except for 2m and 4m are all off the shelf values from normal electronics suppliers, used mainly for computers - and cheap.

The main receiver starts with a casode RF amplifier employing the ubiquitous 2N3819; fairly bomb proof and always stable; an Rf gain control connects to the tail end. There are two tuned circuits at signal frequency: capacitive taps are favoured instead of tapped coils; always to be avoided where possible.

The mixer is the old clunker 1496 which provides useful conversion gain, and a balance pot overcomes the Radio Moscow effect. The injection oscillator uses a simple bipolar transistor with an optional buffer follower for feeding an eventual transmitter.

One of the deficiencies of very simple DC receivers is inadequate filtering. In this circuit a third order Butterworth stage is followed by a second order Chebychey to produce the SSB selection; a further bandpass filter at about 700Hz is selected for CW reception. These occupy three sections of a quad op-amp LM348N, a with the fourth acting as centre line biasing supply for the others.

The ssb/cw selector switch feeds an SL6270 vogad chip which performs audio gain and AGC functions. This is followed by the volume control and the AF output which uses the well known LM380N.

A three gang tuner is necessary of about 20-25pF per section. Other values can be used with a series capacitor; provision for these has been allowed on the PCB. The prototype used a 360pF broadcast type with 47pF in series.

Initial drift was found not to be due to the bipolar, for an FET was tried; nor was it the tuned circuits, but was in fact the three in tapping and coupling capacitors C36, C37 and C39. The med.k ceramics were found to be hopeless and when changed to multilater cog types (expensive) all was well.

For the only reason that it makes the front panel look good, an S meter drive circuit is included on the board. Where not wanted U5, R51, VR4, D2 and C60 may be omitted. A 100uA movement is recommended. The audio power stage is supplied from the 15v input; a 78L12 stabilized then feeds all the other stages.

THE CONVERTERS

The signal path is similar in all converters from 80 to 2m: an FET cascode RF stage is triple tuned, its tail or source resistor being routed to the RF gain control along with the other RF amplifier in the main receiver board. The mixer is a low noise dual gate BF981. It is possible to use a similar device on 2m and 4m converters.

Various bands demand differing oscillator chains; a simple fundamental crystal on most low bands; and overtone on 4m, 6m and 10m; fundamental plus doubler as an option for 10m; with overtone plus doubler for 4m and 2m. All these different configurations are possible on the one board layout by wiring what is needed; a coupling capacitor acts as link to a common bus which feeds gate two of the mixer. See sheets 3 and 4. The mixer output is wideband coupled into the short 50 ohm link to the main board where L6 selects the wanted frequency. The low impedance link plus nice short connections at the socket ensure no pick-up of the noisy 6MHz broadcast band.

Converters have DIN41617 plugs (25p at rallies) with a common socket in the receiver chassis.

Gain is such as to allow good reception on all bands with just a short whip aerial, hence the RF gain control for use when a tuned aerial is connected. Easily copiable signals have been measured down to 0.06uV.

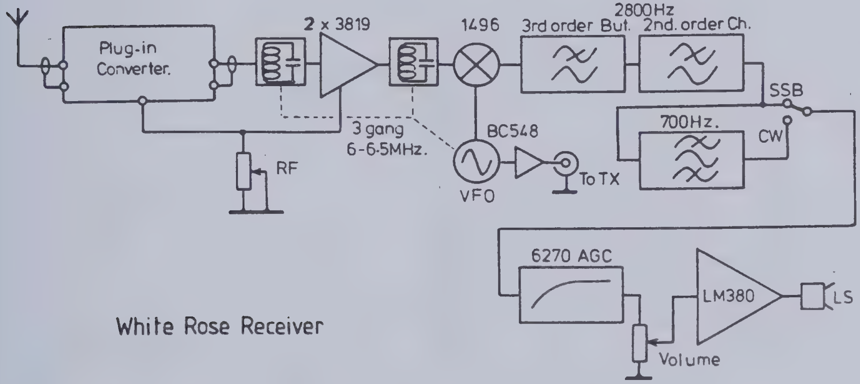
EXTRA NOTES:

R26 (1K) is made up from two 470 ohm in series to improve layout.

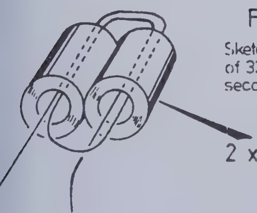
22MHz crystals are available from Quartslab at £3 for 10m & 6m converters. For 10m, follow instructions on sheet 3. For 6m, use 2m and 4m circuit on sheet 4 with values for appropriate bands.

160m: as 4.5MHz crystals are sometimes difficult to obtain, if you don't mind reverse tuning, use 8MHz crystal; L1, L2, L3 20uH (67t 42 swg, C1, C6, C7 390pF, C2 3300pF, C12 120 pF, C13 180pF.

Ferrite Transformer: 2x FX1115; wind 10t 32-36 swg primary, and 2t 28 - 26 swg secondary, wind tightly.

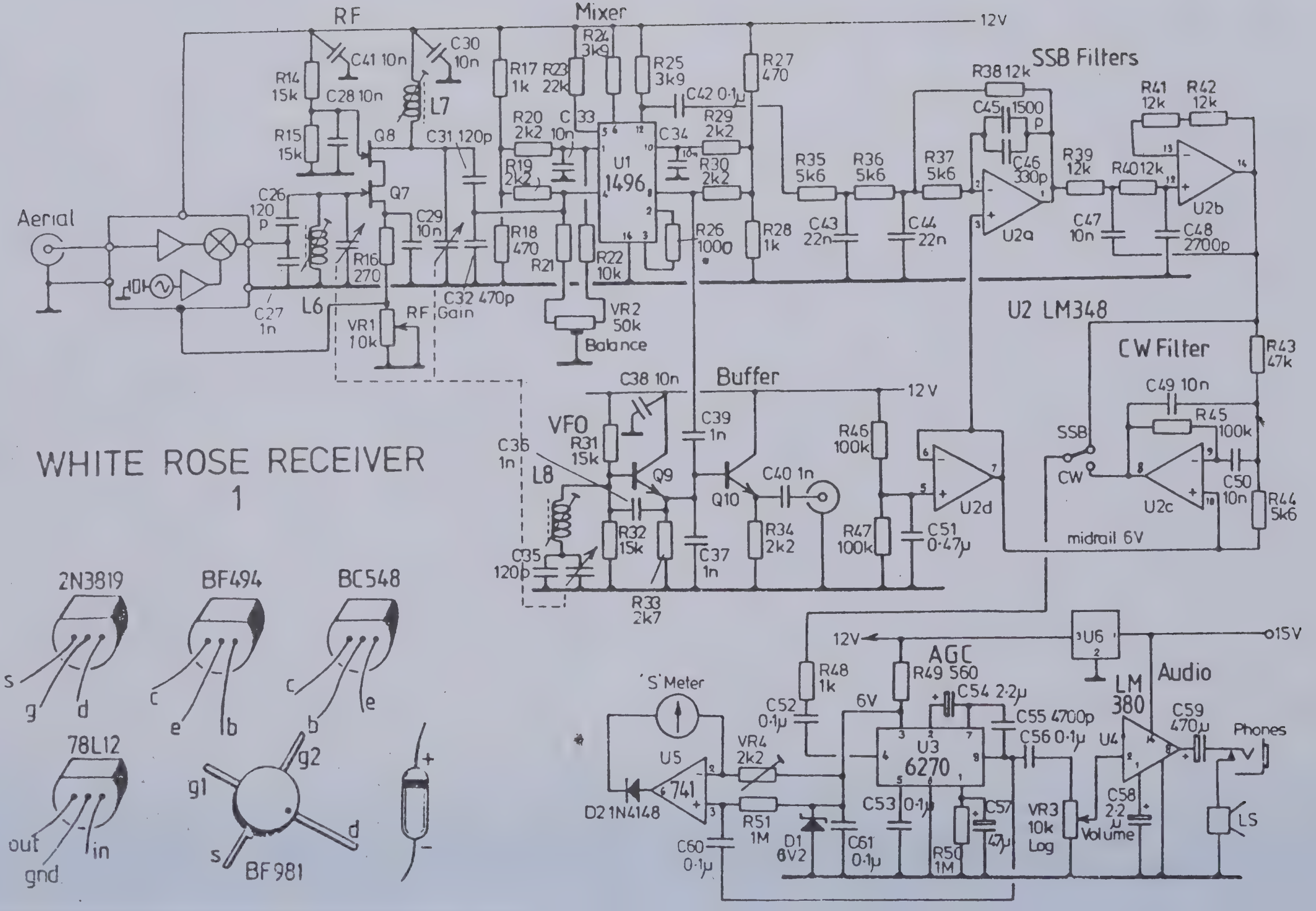


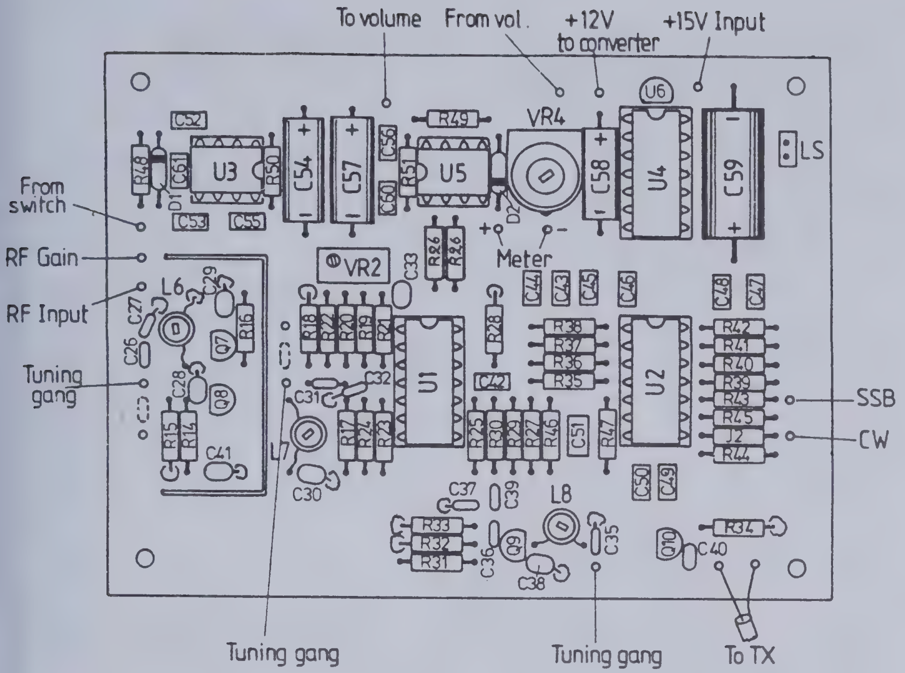
White Rose Receiver



Ferrite transformer

Sketch shows two turns. Wind 10 turns of 32-36 SWG on primary; 2 turns on secondary 28 SWG. Keep windings tight.


WHITE ROSE RECEIVER 1



PARTS LIST

R1, R2, R7• R8, R14, R15, R31, R32	15k	
R3, R16		
R4		
R5, R45, R46, R47	100k	
R6, R49, R11	560	
R9	1k5	
R10, R19, R20, R29, R30, R34	2k2	
R12		
R13		
R17, R28, R48	1k	
R18, R27	470	
R21, R22	10k	
R23	22k	
R24 R25	3k9	
R26	1k	2×470Ω
R33	2k7	
R35, R36, R37, R44	5k6	
R38, R39, R40, R41, R42	12k	
R43	47k	
R50, R51	1M	
	•39k	
VR1	20k lin	
VR2	50k 10 turn	
VR3	10k log	
VR4	2k2 skel.	
J2	27Ω	

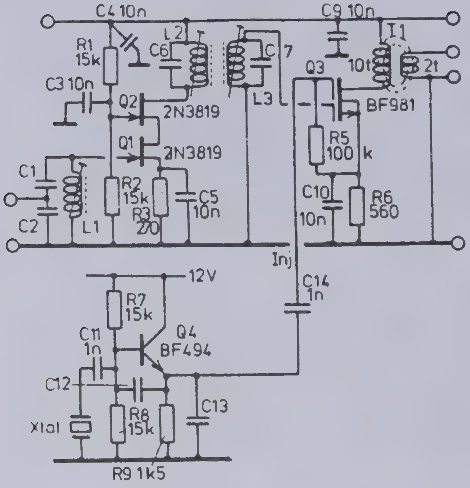
C1, C2, C6, C7, C12, C13, C14, C15, C16, C20, C21	See sheet 3 and 4
C3, C4, C5, C8, C9, C10, C18, C19, C23,	
C28, C29, C30, C33, C34, C38, C41	10n hi K Disc
C11, C14, C17, C27, C39, ~~C36~~, ~~C37~~, C40	1n med K ceramic *
C26, C31, C35	120p Lo K ceramic
C32	470p med K ceramic
C42, C52, C53, C56, C60, C61	0·1μ polyester
C43, C44	22n "
C45	1n5 "
C46	330p "
C47, C49, C50	10n "
C48	2n7 ceramic
C51	0·47μ polyester
C54, C58	2μ2 16V elect.
C57	47μ 16V "
C59	470μ 16V "
C55	4n7 polyester

SEMICONDUCTORS

U1	MC1496N	Q1, Q2,	
U2	LM348N	Q7, Q8	2N3819
U3	SL6270C	Q3	BF981
U4	LM380N	Q4, Q5	BF494
U5	LM741CN8	Q9, Q10	BC548
U5	LM78L12ACZ		
D1	BZX79C6V2		
D2	1N4148		

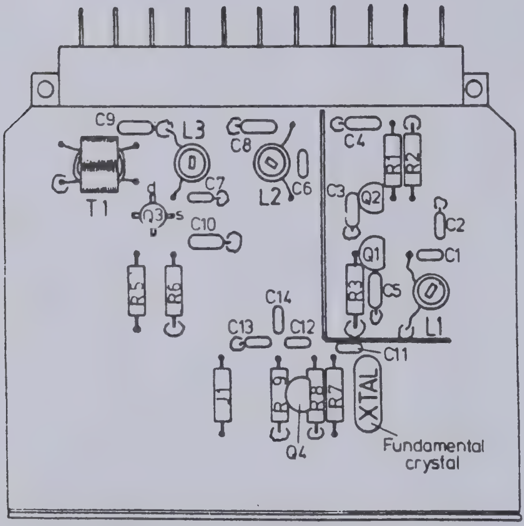
* C36, C37, C39 1n COG Multilayer

WHITE ROSE RECEIVER 3



Converters using fundamental mode crystals

	80	40	30	20	15
Xtal	2·5MHz	1MHz	4MHz	8MHz	15MHz.
C1	220p	120p	68p	56p	39p
C2	1800p	1000p	560p	470p	330p
C6,C7	220p	120p	68p	56p	39p
C12	390p	470p	220p	120p	82p
C13	560p	680p	330p	180p	120p
L1,2,3	44t	31t	28t	22t	14t

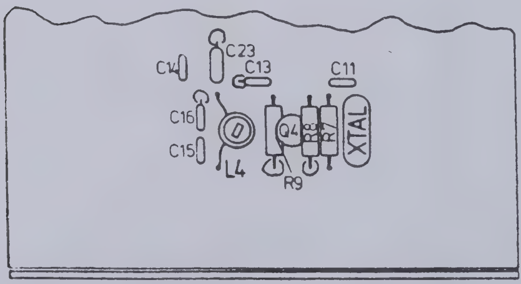


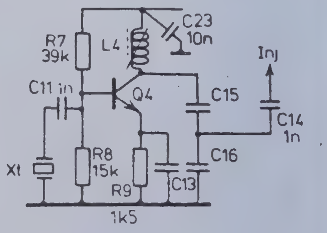
(J1 = zero ohm resistor)

J1 zero ohm resistor

Converters using single stage overtone oscillator

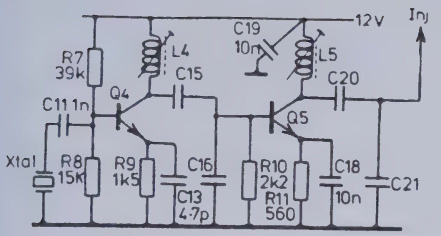
	10	6	4
Xtal	22MHz	44MHz	64MHz.
C1	27p	15p	10p
C2	270p	120p	82p
C6,C7	27p	15p	10p
C13	5·6p	4·7p	4·7p
C15	39p	18p	12p
C16	150p	68p	47p
L1,2,3	12t	9t	8t
L4	19t	13t	9t





WHITE ROSE RECEIVER

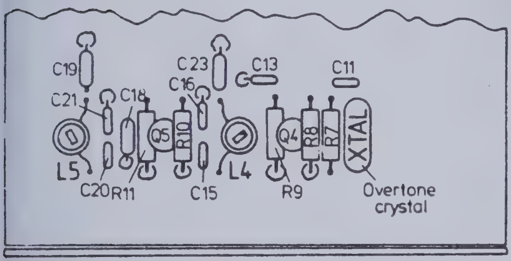
4

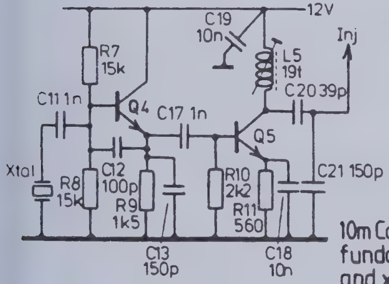


Osc chain for 4m and 2m converters : overtone oscillator and multiplier.

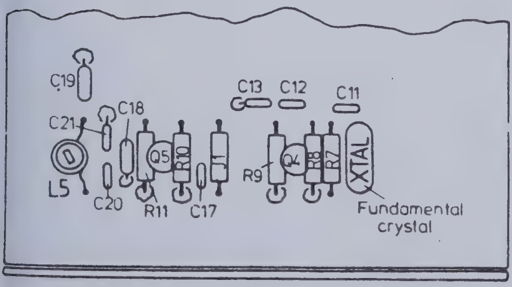
	4m	2m
Xtal	32MHz.	46MHz.
Mult	x2	x3
C15	22p	18p
C16	100p	68p
C20	12p	5·6p
C21	47p	22p
L4	16t	12t
L5	9t	5t

Q1,Q2 replaced by single BF981 in 2m board.





10m Converter with fundamental osc and x2 multiplier.

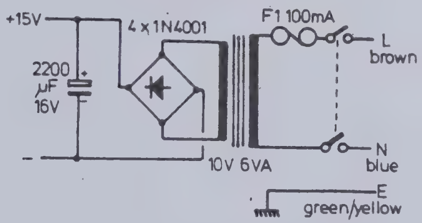


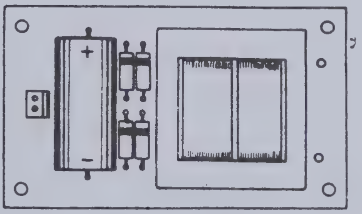
COIL TABLE

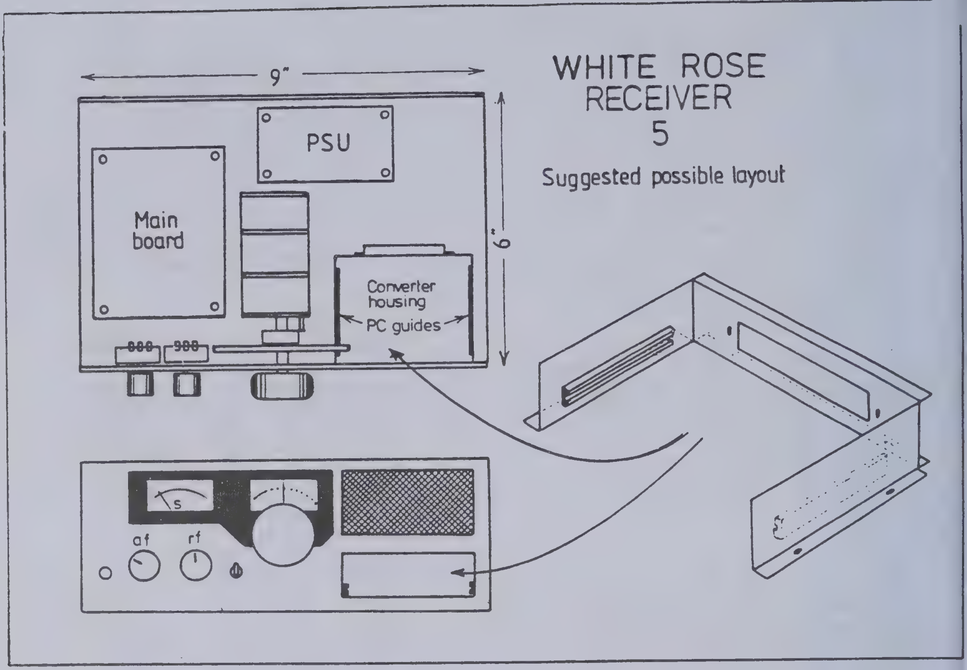
All coils are close wound on 3/16" formers.

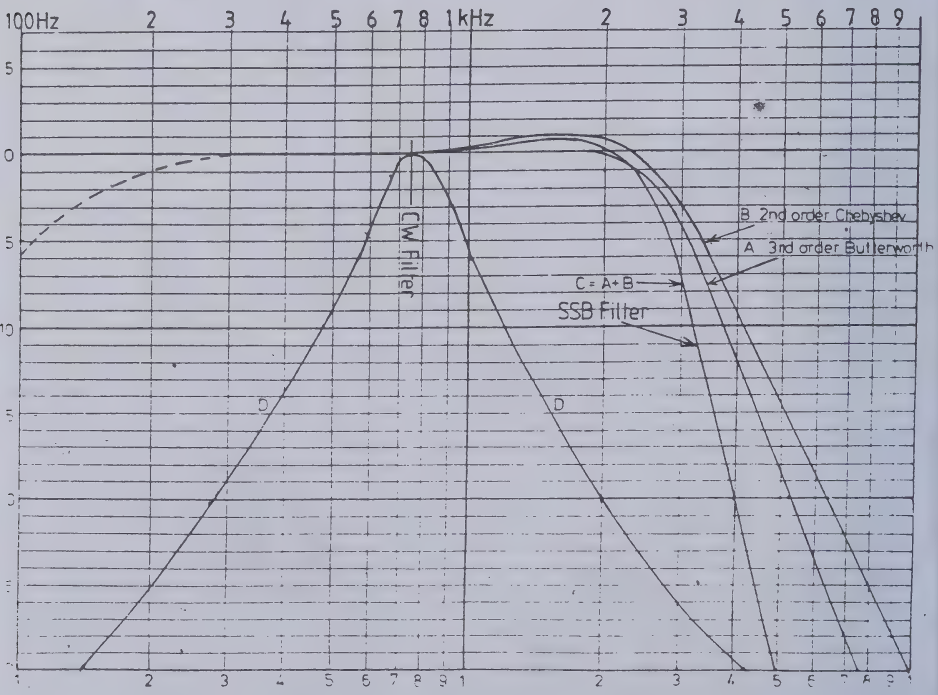
L1 L2 L3				
3·5MHz.	8·64μH	44t	3 layers	32-36 swg
7MHz.	4·3μH	31t	2 layers	32-36 swg
10MHz.	3·72μH	28t	2 layers	30 swg
14MHz.	2·3μH	22t	single	30swg
21MHz.	1·47μH	14t	"	28swg
28MHz.	1·2μH	12t	"	26swg
50MHz.	0·675uH	9t	"	26swg
70MHz.	0·5μH	8t	"	25swg
144MHz.	0·22μH	4t	"	24swg
L4 overtone				
28MHz.	(22MHz)	19t	single	30swg
50MHz.	(44MHz)	13t	"	26swg
70MHz.	(64MHz)	9t	"	26swg
70MHz.	(32MHz)	16t	"	28swg
144MHz.	(46MHz)	12t	"	26swg
L5 multiplier				
28MHz.	(22MHz)	19t	"	30swg
70MHz.	(64MHz)	9t	"	26swg
144MHz.	(138MHz)	5t	"	24swg
L6,L7,L8				
6MHz.	5·2μH	36t	3 layers	32-36swg

POWER SUPPLY

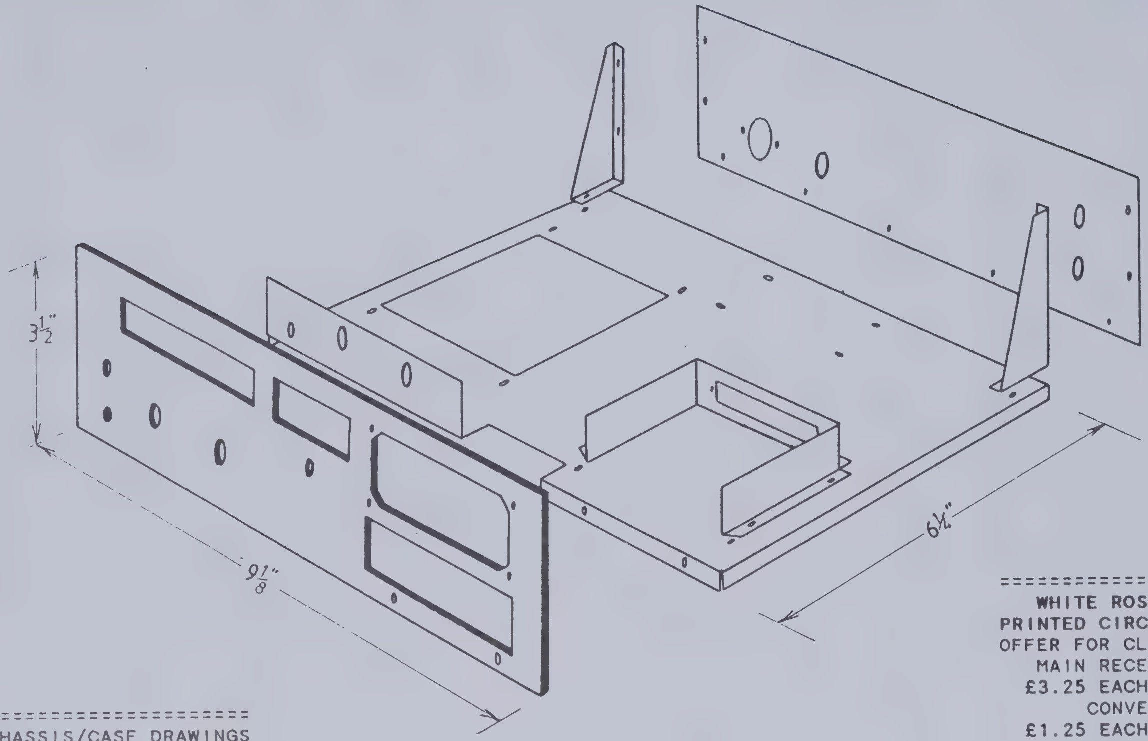





WHITE ROSE
RECEIVER
5
Suggested possible layout
9"
6"
PSU
Main board
Converter housing
PC guides
af
rf
s


100Hz
2
3
4
5
6
7
8
1kHz
2
3
4
5
6
7
8
9
5
0
5
10
CW Filter
B 2nd order Chebyshev
A 3rd order Butterworth
C = A+B
SSB Filter
D
D

White Rose Construction Project
Receiver Chassis



FULL CHASSIS/CASE DRAWINGS
WITH ALL THE REQUIRED DIMENSIONS
Available from G3RJV for an SAE.

WHITE ROSE RECEIVER
PRINTED CIRCUIT BOARDS
OFFER FOR CLUB MEMBERS
MAIN RECEIVER BOARD
£3.25 EACH [P&P 20p]
CONVERTER BOARD
£1.25 EACH [P&P 20p]
From Dave Aizlewood G4WZV,
36 King Street, Winterton, Scunthorpe,
South Humberside, DN15 9TP. (Cheques "G QRP CLUB")

A BI-DIRECTIONAL INLINE WATTMETER

DAVID STOCKTON G4ZNQ

GOOD ACCURACY FREQUENCY INDEPENDANT NO ADJUSTMENTS
LOW INSERTION LOSS WIDE POWER RANGE SIMPLE TO BUILD

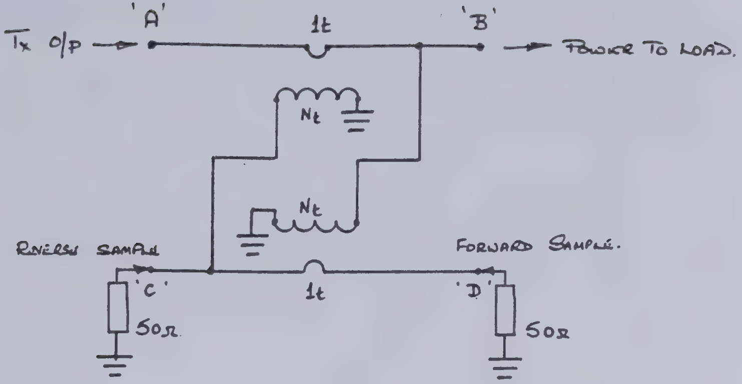
Asked to build a "transmitter VSWR meter", my fancy was taken by two variants of the Bruene circuit and I built one of each. The first uses a resistive potentiometer to sense the line voltage - found in the RSGB Manual. The second uses an autotransformer to sense the line voltage - found in an article by Ulrich Rohde in the US HAM RADIO magazine. Both proved to be less sensitive to stray than their ancestor, but I felt it might be possible to do better. The cause of their sensitivity to stray capacitance is the high impedance which the detectors present. Some calculations also showed that this high impedance was also limiting performance at the lower end of the range.

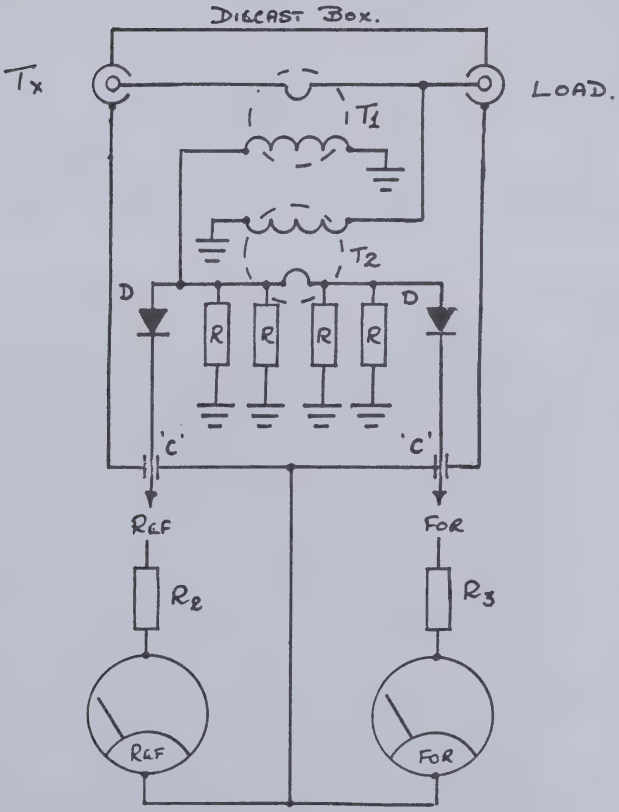
I started thinking of low impedance alternatives and suddenly remembered some professional work I had done on return loss bridges some 10 years ago. It happens that as circuit impedances are lowered, the bandwidth over which a transformer is usable increases, and I had designed a transformer based bridge which was usable from 10KHz to 40MHz with laboratory instrument class accuracy. This made me suspect that choosing a circuit with controlled, low impedances would be beneficial all round.

To experiment with transformer design I built a true 4-port Hybrid intended for 50 ohm use. A hybrid is a very simple circuit - just 2 transformers and 4 connectors - with some amazing properties. The connectors or ports are best thought of as two pairs. If a signal is passed in one connector and out of the other of a pair, into some unknown impedance load (say an antenna) then, if both of the other connectors are terminated in the intended system impedance (say 50 ohms) then the hybrid feeds a fraction of the power passing forwards through the first pair of connectors into one of the terminations. It feeds an equal fraction of the reverse power passing forwards through the first pair of connectors into one of the terminations. It feeds an equal fraction of the reverse power flow into the other termination. Hybrids can be designed to have different sampling fractions, usually quoted in dB, so a 20dB Hybrid diverts 1% of the flowing power to the appropriate terminated port. The really wild properties are that the circuit is symmetrical and the 2 pairs of ports can be reversed with no effect on function or performance, the signal can be fed through in the opposite direction in wbich case the forwards and reverse samples to the terminations are interchanged. Finally the hybrid itself contains nothing to set its operating impedance - the terminations on the sample ports do this. To convert a 50 ohm transformer hybrid into a 75 ohm one, just change from 50 to 75 ohm sample port terminations. If a large change of operating impedance is wanted, a transformer re-design may be needed to avoid some loss of bandwidth.

This circuit very nicely illustrates one of my favourite points. There is not necessarily any relation between number of components and "complexity". The operation of this circuit is extremely difficult understand, yet it only uses two components. Fortunately it is easy to build and easy to use.

Look at the symmetry of the circuit - due to a balancing effect of the transformers we can turn the circuit upside down, sway left for right, (or both) and it would still work the same.
Let us arbitrarity choose to feed our power into connector 'A' so our power passes through the transformers and 99% of it comes out of 'B' and goes to our load (the antenna) 1% comes out of connector 'D' and into its 50 ohm resistor.





METERS MAPLIN 50uA - 2 Needed
(not supplied in Kanga Kit)
R= 100 ohms R2 = R3 (22K for 5W FSD. 56K for 20w FSD)

If the antenna does not present a perfect 50 ohm impedance, some power will be reflected and will pass backwards through the hybrid from B to A only 99% of the reflected power reaches 'A'.
1% is diverted to connector C and is dissipated in its 50 ohm resistor. In order to work, it is essential that C and D are terminated with good 50 resistors. The hybrid relies heavily on the match of ports 'C' and 'D'>

A prototype was built. The transformers were made with toroid cores of type S1 ferrite made by SEI (Salford Electrical instruments, Heywood, Lancs.) (Colour code: YELLOW) This ferrite is quoted for use to 2 MHz. Such statements usually refer to the range over which high - Q inductors can be made. Transformers are much less demanding and the usable frequency range is extended. The controlled impedance levels of the two transformers is very favourable and operation is good to about 50 MHz.

The prototype transformers had a single "primary" (with faraday screen) and a 12 t "Secondary".

With 12t, the coupling factor is - 21.584 dB. The prototype was measured at -21.59 ± 0.01 dB over 1.5 to 50 MHz. This flatness is excellent and the proximity to the calculated value for the first hybrid made (no adjustment or selection was done) shows the degree of confidence which can be placed in this type or circuit.

Plots of through path attenuation (<0.1dB 1.5 - 30 MHz) Coupling factor (21.59 ± 0.01 dB 1.5 - 30 MHz).

Directionality is the measurement of how well the hybrid can separate forwards and reverse samples. >23 dB directional power meter, we need only to add two termination resistors (50 ohms) and two diode detectors.

With a 21.6 dB (12:1 turns ratio) coupling factor the forwards termination dissipates 0.69% of the forwards power so two 100 ohm 1/2W resistors in parallel would be ideal for use with up to 150w continues carrier transmitters (580w PEP, unprocessed).

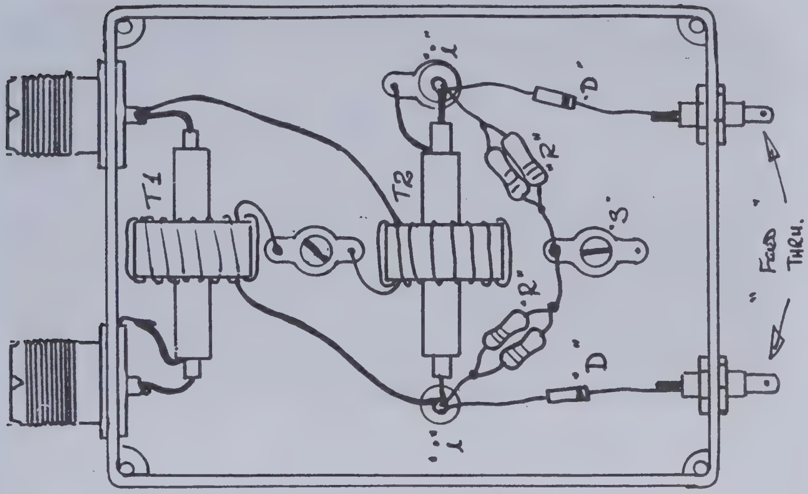
A good match gives zero reflected power. Interchanging the RF ports just causes the function of the two meters to be interchanged.

Two meters are really essential in this circuit, switching one meter merely detracts from the usefulness of the principle. Note that the principle of individual forwards and reflected power meters which do not have a VSWR scale not do Bird Thruline meters, not in one needed. If you know Forwards and Reflected power, you can esily convert to Return Loss (or VSWR) if you really wish.

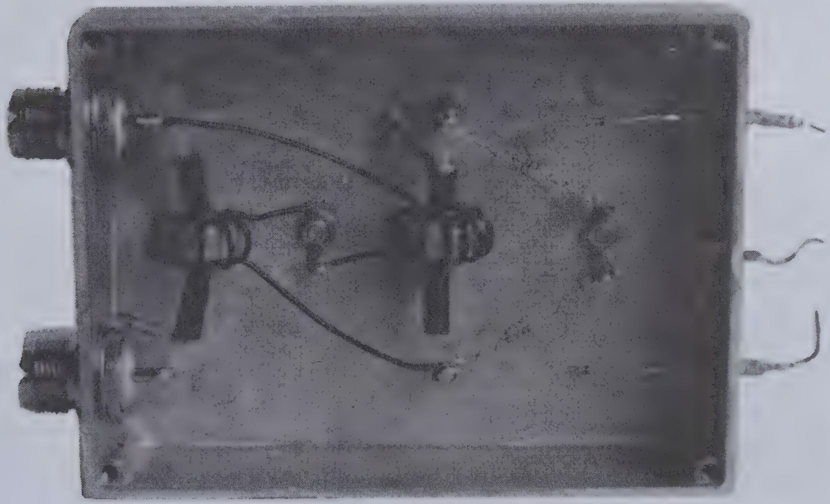
$$\text{Return Loss} = 10 \log_{10} \left(\frac{\text{Reflected Power}}{\text{Forward Power}} \right)$$

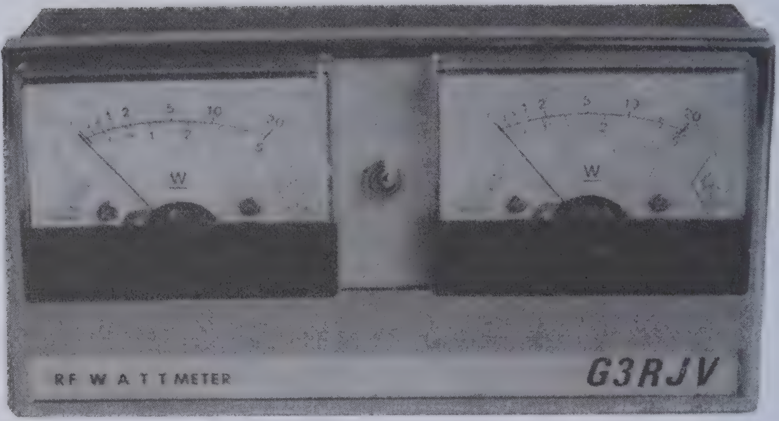
KANGA KIT VERSION
The protographs and diagrams refer to the Kanga Kit version of the Power Meter. This kit includes all that is shown in the "head" of the meter including the case, the special cores for T1/2 and all components. Two self adhesive scales are provided for the kit with two ranges: 5 watts and 20 watts FSD. This scale is designed for use with the MAPLIN 50uA Meter type FM98G. This meter is amongst the cheapest quality meters available. Several prototypes built with these meters showed excellent accuracy.

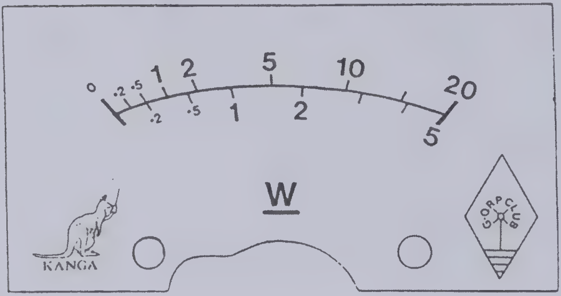
KIT PRICE TO CLUB MEMBERS (exc meters) £13.95 (post £1) from Kanga.



i = Standoff Insulators
T1/T2 = 12t. PVC covered wire - see text
Fit a tag on outside of case at S for Meter Negat
R = 100 ohm Low Inductive Resistors
D = Schottky Diodes
Feed Thru Capacitors - any value 1000 - 20,000pF







WATTMETER SCALES (5w & 20w FSD) Stick-on Scales 2 supplied with kit These are for use with the stated values of R2 and R3 in the article. Alternative higher (up to about 200w) or lower full scale deflections can be had by changing R2 and R3.

EK3QRP on the EU/AS Border (Mt. Volchikha)

Left to Right:
RA9CCE - Sergej
RV9CIA - Boris
UW0LCN - Victor (seated)
RV3GM - Oleg (On Top)
UZ3GXX - Olga (xyl RV3GM)

The U QRP Club expedition in July 1989. 1590 QSOs in 10 days, all under 5w. 65 DXCC, All Continents, 135 Oblasts and many G QRP Club members inc. G8PG, G3YCC, OH9VL, I7CCF Most interesting QSO was WF9Y running 80mW on 20m. EK3QRP used a Homemade Transceiver with simple wire antennas on all bands.

Report by Oleg RV3GM

THE FO-RECEIVER

HA-JO BRANDT DJ1ZB

This receiver has been designed for my voyage to French Polynesia in September 1989 (in conjunction with two separate 2 W VXO transmitters for 14 and 21 MHz) and has also been used during a recent stay in Norway before Xmas.

Mixer selection

The main design goal was to increase a.f. amplification as far as possible, to avoid the necessity of a rf amplifier which would have increased mixer over load problems under critical receiving conditions. Firstly I tried the singly balanced twin diode mixer known from the Oner Imp, Unichip or Alpha setups but found them unsatisfactory. This mixer type allows to balance out AM breakthrough, but cannot suppress oscillator radiation towards the aerial. Therefore, when tuning the input resonant circuit, strong dc pulses are generated which block the high gain af amplifier for fractions of a second. This wan not the case with a doubly-balanced mixer such as the SBL-1 or similar. With doubly-balanced mixers, these dc pulses are just noticeable at high af gain and may be used to set the input resonant circuit as long as no rf signal is present.

AF amplifier

Cheap popular stereo headphones, paralleled to an impedance on 16 ohms nominal, should be used for reception. Typical op amps do not have sufficient output current capability. For economical reasons of current consumption, a matching transofrmer has to be used in any case. For a 12 volts upply I chose a simple class A amplifier at 6mA and a 10:1 output transofrmer (turns ratio). All collector outputs show a blocking capacitor to ground to attenuate audio frequencies

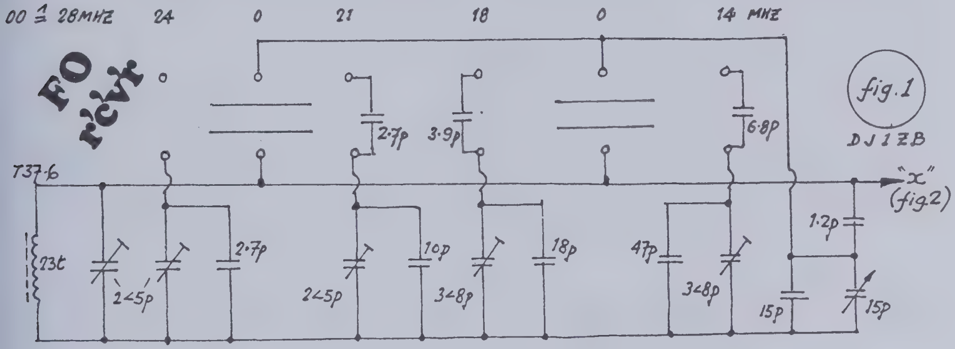


fig.1

DJ1ZB

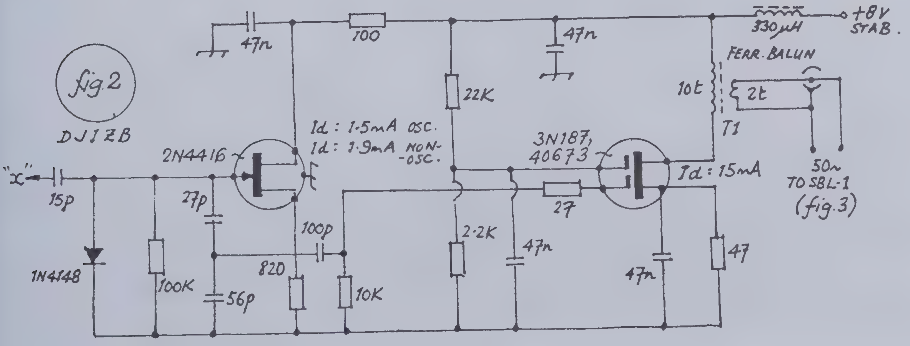
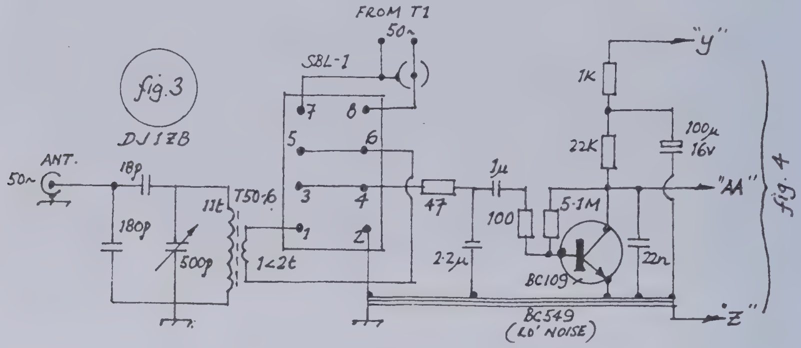


fig.2

DJ1ZB

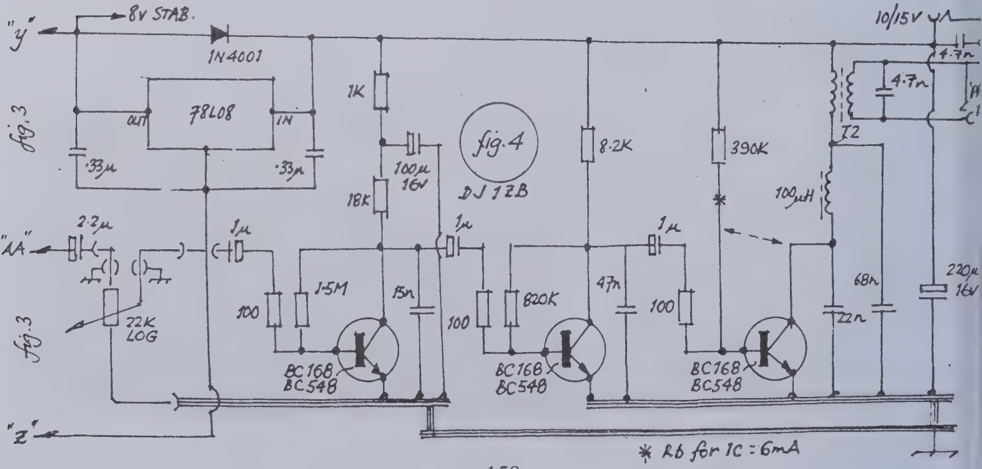
above 800 Hz. On another occasion it has been observed that these high gain transistors tend to oscillate on VHF if base and collector are blocked (this is also the case here due to the coupling between stages). Therefore a series resistor (100 to 470 ohms) is employed at each base input (oldtimers will recall the 1 k resistor at the control grid of high transconductance tubes in af amplifier).



Oscillator section

Due to the frequency ratio of 2:1 it is possible to employ a single coil for all five ranges. Band switching is done by two DPDS miniature switches with an open middle position. One section is to change the parallel capacitance to get to the various bands, the other changes the band spread capacitor. With the values shown only a part of the cw bands is covered, but definitely more than the pulling range of the associated VXO transmitters.

The dual gate buffer amplifier output is fed to the SBL-1 oscillator input via a ferrite balun transformer. The optimum turns ratio seems to be 10:2, delivering 0,4 to 0,6 volts across pins 7 and 8. The inductance delivered by the 10 turns is also roughly*tuned to the total circuit and dual gate fet output capacitance for best broadband performance between 14 and 28 MHz. The original core is a SIEMENTS B62152 A0007-X001, but an Amidon BN-61-2402 should give similar results.



Ground leads

In order to avoid motor-boating due to the high af amplification, care must be taken with the ground leads on a pcb or open wiring. The ground of the first af amplifier is referenced to the rf ground of the mixer, which is contacted to the metal case by a mounting bolt. The grounds of the other stages are referenced to the negative pole of the main supply blocking capacitor, which is contacted to the metal case by a separate bolt (assuming that the case itself has negligible resistivity between these points).

Receiving performance

In the Pacific area the high af amplification was definitly needed to copy and work other qrp stations. AM breakthrough has never been observed, and selectivity was sufficient in most cases.

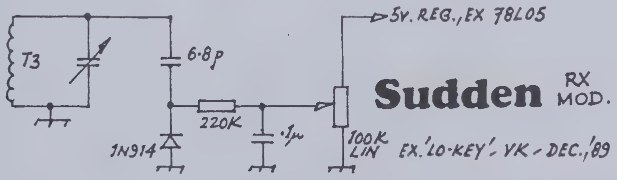
Here is Europe one may find the maximum af amplification too high, the selectivity more critical, and encounter some AM breakthrough in the late afternoon and early evening. AF amplification may be lowered by connecting the base resistor of the final transistor to its collector terminal to introduce some feedback. Furthermore the output link of the preselector should be just one turn, and an aerial input attenuator of about 20 dB may be switched in under critical receiving conditions.

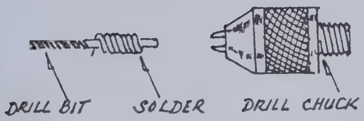
The 4.7 nF capacitors across the supply and headphone terminals have been found necessary to prevent rf pickup from the own transmitter when operating on 28 MHz. Under these conditons pulling of the oscillator has never been observed, and the receiver may always be used to monitor the own cw signals.

SUDDEN RECEIVER MODIFICATION

VK2CWH

Considering its simplicity the Sudden works well. Even with a reduction drive I found it too coarse to resolve SSB easily, so I added a R.I.T. I removed the 100pF in parallel with the tuning gang and added 6.8pF in the R.I.T. section, using a 78L05 regulator (TO-92 case, 100mA) to provide the R.I.T. voltage. This allows easy fine funing and, after realigning T3, covered from 3.5 to about 3.75MHz.





DRILL TIP

VK6BWI

A tip about the problem we all have from time to time. Some drill chucks do not adjust right down to 1mm, or less, to accept PCB drill bits.

To cure this, wrap a piece of thin solder around the end of the drill bit which fits into the chuck. This method can also be used to salvage snapped drill bits - if you can find them on the floor!

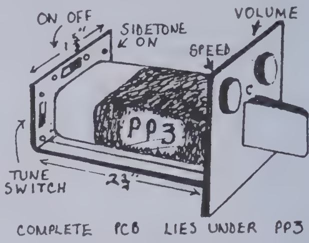
AN S.M.D. IAMBIC KEYER SYSTEM (PART 1)

Jack Glennon G4ZQK and Bill Mooney G3VZU

Jack : My interest lies in simple miniaturized QRP Transceivers but I was not happy about the accessories (keyer ATU etc) being larger than the rig. Having built several rigs with internal keyers, I decided to build a keyer and touch paddle which would form the basis of any future project.

I obtained SMD components through Bill of Blue Rose Electronics and designed the layout to be as small as possible. The size of my keyer section is just 1 1/4" x 1 3/16" - I left enough room for a thermos flask!

Footnote: If G3ROO builds this on a 1" square PCB then I will jump in the canal (I also lied about the Thermos Flask!!)



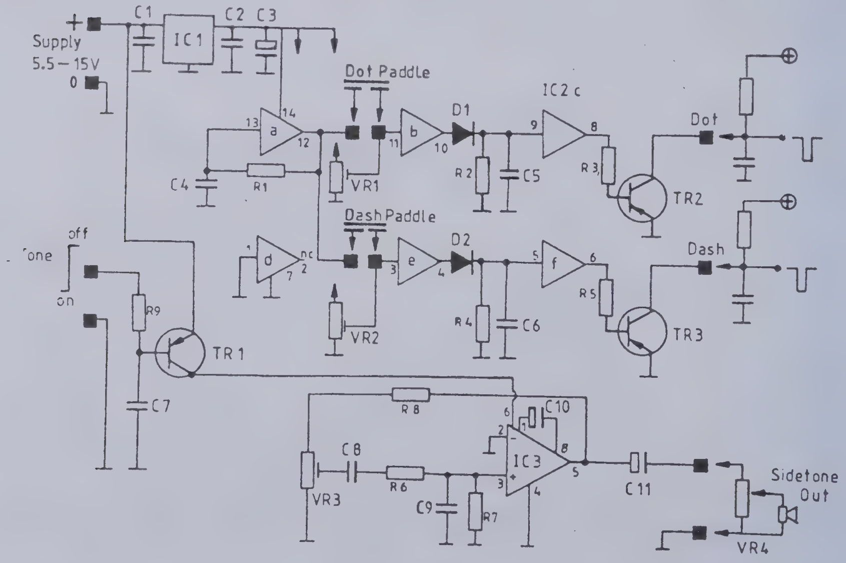
PROTOTYPE OF G4ZQK KEYER

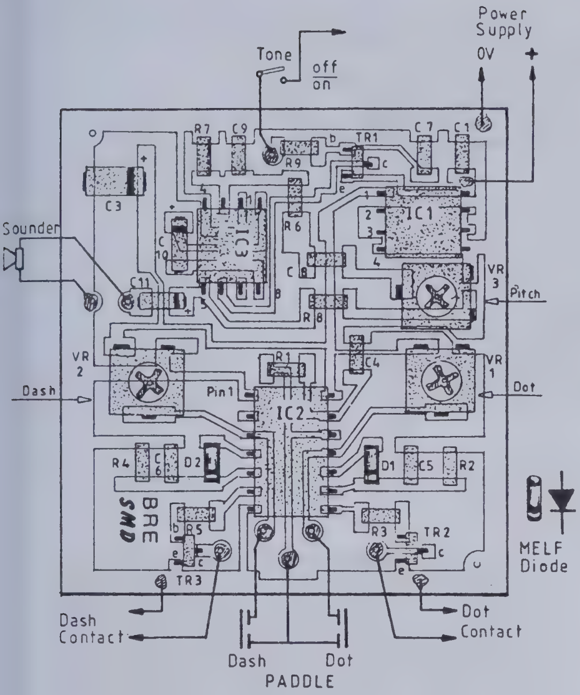
S.M.D. CAPACITIVE TOUCH PADDLE : G3VZU

This Touch Paddle unit to the PCB designed by Jack (G4ZQK) will run most IAMBIC circuits, a sidetone is included and would normally be keyed on and off by the IAMBIC circuit

Most of the work is done by a single 4046 IC. IC1a is a 60kHz oscillator fed to the touch paddles. Each paddle is two capacitors in series made from double sided PCB. The connection between these capacitors is the touch plate. Touching (grounding) the plate reduces the 60kHz signal going to IC1b or e. D1 and D2 rectify the outputs such that gates IC1c and f have a "1" on their inputs inverting to turn TRs 2 & 3 off. VR1 (& 2) is adjusted to the point where the schmitt will switch to a low output state in absence of AC (touching paddle). This gives a high output on pin 8 (or 6) turning on TR2. The low dropout regulator gives excellent battery life. The sidetone oscillator is really an independant circuit on the same PCB switched by the main keyer board.

THE CIRCUIT AND THE SMD PCB LAYOUT ARE FOR
THE BLUE ROSE ELECTRONICS KIT VERSION (SEE ADVERT THIS ISSUE)
THE SMD IAMBIC KEYER WILL APPEAR IN THE NEXT ISSUE



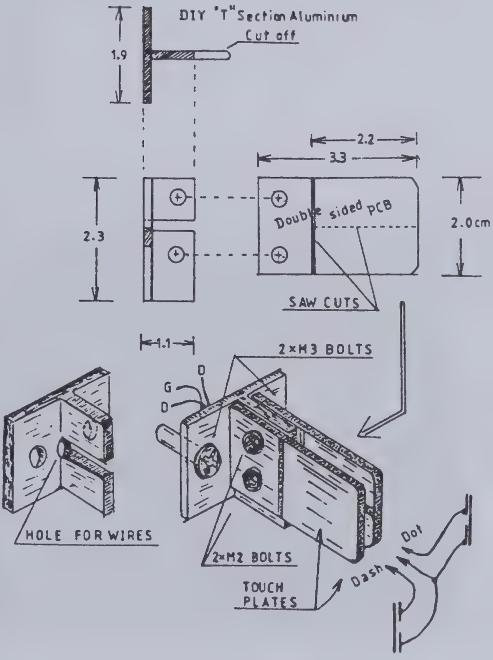


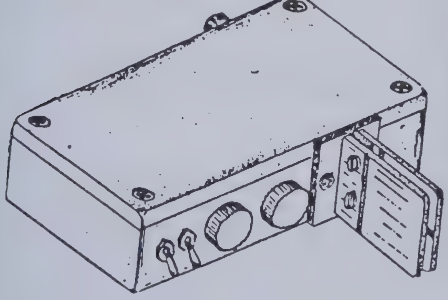
TOUCH PADDLE COMPONENTS

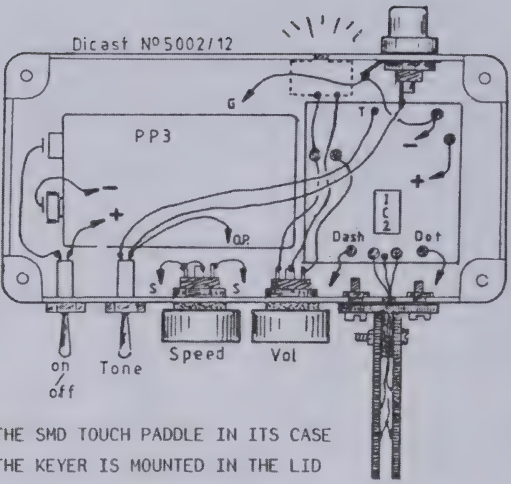
Resistors	
R1	10k 1206 chip
R,4,	470k 1206 chip
R3,5	47k 1206 chip
R6,7,8	3k3 1206 chip
R9	4k7 1206 chip
VR1,2,3,	50k Trimpot 3204
Capacitors	
C1,2,5,6,7,8,9	47n 1206 chip
C3	22uF Tant
C4	3.3nF 1206 chip
C10,11	4.7uF Tant
Devices	
D1,2	BA532 MELF SMD
TR1	BCW30 PNP SOT23
TR2,3	BCW32 NPN SOT23
IC1	LM2931 SO8
IC2	40106 SMD
IC3	LM386 SMD

SIMPLE PADDLE UNIT

A sturdy paddle unit may be built as shown from two pieces of double sided PCB and a short length of T Section DIY aluminium extrusion. The PCB spaces are made with saw cuts. A hole in the centre of the aluminium support carries the leads, almost out of sight, into the box. Polish the copper and spray with PCB lacquer. A diecast box Bimbox 5002 will take the paddle and a PP3 Battery and will also hold the SMD IAMBIC keyer board. P16 Knobpots are used to conserve space



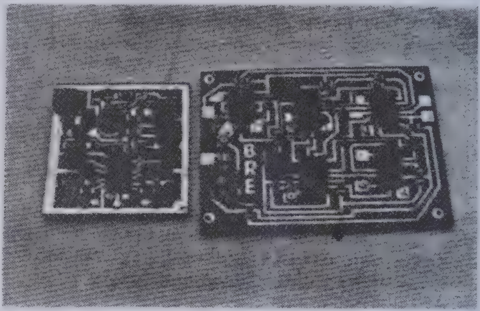




THE SMD TOUCH PADDLE IN ITS CASE
THE KEYER IS MOUNTED IN THE LID

THE SMD PADDLE KEY PCB
(LEFT)

THE SMD IAMBIC KEYER
(RIGHT)



THE SMD IAMBIC KEYER
SHOWING THE RELATIVE SIZE

This Keyer will be described
In the next issue of SPRAT

AUDIO PREAMP AND PASSIVE FILTER FOR NE602 MIXER

STEF NIEWIADOMSKI

I was interested to see the Sudden article in SPRAT 58, using the NE602 IC. It is certainly a versatile chip, making design and construction of DC and superhet receivers very straightforward. After seeing the article, I decided to design a 40m DC receiver, based on the NE602/LM386 combination. I managed to get hold of the Mullard data on the NE602 and I noticed that the output from the chip appears in antiphase on pins 4 and 5, whereas most published applications use only one of these outputs. Since I wanted to incorporate an audio pre-amp and passive audio filter, I thought I would make use of both outputs.

My final circuit is shown in the attached diagram. The 1000pF capacitors on the NE602 outputs prevent some of the RF products produced by the mixer from reaching the op-amp. Both inputs of the op-amp are used, driven in antiphase by the NE602 outputs. If required, the gain of the op-amp can be varied by changing the 100k feedback resistor.

The audio filter is designed for 1.5k ohm drive and terminating impedances. Because the op-amp has a low output resistance, the drive impedance for the filter is provided by a series 1.5k resistor. If the extra gain provided by the op-amp is not needed, the filter can be driven directly from pin 4 or 5 of the NE602 without the need for any resistor.

The filter is a third-order 300Hz Butterworth highpass section cascaded with a fifth-order 3kHz 1dB passband ripple elliptic lowpass section, giving excellent out-of-passband rejection. The highpass section gives 47 dB of attenuation at 50Hz, eliminating mains hum problems often asssociated with DC receivers. The lowpass section reaches an attenuation of more than 60dB at 1.66 times its cutoff frequency. An overall 6:60dB shape factor of about 1.84, comparable with a good quality crystal filter, is achieved. Note that all the components are E12 standard values.

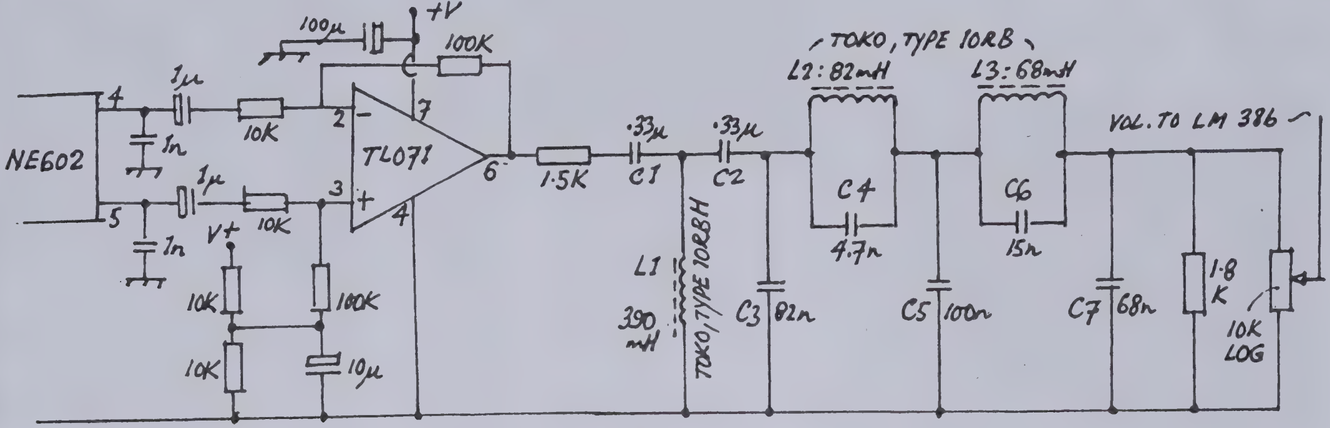
Termination is provided for the filter by the parallel combination of the 1.8k resistor and 10k volume pot.

I know the reaction of many amateurs to the sight of inductors in audio filters! Do not despair, however, because the inductors used here are off-the-shelf ready-wound miniature components made by Toko. They are types 10RB and 10RBH, available from Bonex and Cirkit. Their small size (10.5mm diameter and 14mm high, about the same as a low voltage 100uF electrolytic) and low weight makes them ideal for use in compact portable equipment. For the capacitors in audio filters, I always use the polyester layer type: again they are small and available from several sources (Electrovalue, Maplin, Cirkit etc). It has been shown (references 1,2,3) that the performance of such filters is not significantly degraded by the comparatively low Q of the inductors and rounding the values of the components in them.

Filter impedances other than 1.5kohm can be accommodated by scaling the filter component values. It is best to use exact values when scaling to another impedance, to prevent 2 sets of rounding errors.

SHORT LOADED DIPOLE PROGRAM (SEE SPRAT 60) NOW CONVERTED FOR BBC B

A conversion of the original programme by Ron, G3DSV, and his son G6CQB, for the BBC "B" with the wire gauges in swg is available as a listing from G3RJV for a self-addressed and stamped envelope.



AUDIO PREAMP AND PASSIVE FILTER FOR NE602 MIXER

STEF NIEWIADOMSKI

For this filter the exact values are:

	rounded value	exact value
C1,2	0.39uF	0.354uF
C3	82nF	77.5nF
C4	4.7nF	5.35nF
C5	100nF	98.23nF
C6	15nF	14.5nF
C7	68nF	69.85nF
L1	390mH	398mH
L2	82mH	75.7mH
L3	68mH	64.8mH

If the new filter impedance is R ohms, then the new capacitors have the value:

$$\text{Cnew} = \frac{\text{Cold} \times 1500}{R}$$

Similarly, the new inductors are found by:

$$\text{Lnew} = \frac{\text{Lold} \times R}{1500}$$

Hence, doubling the filter impedance results in half the original values for the capacitors and double the original values for the inductors. When the impedance scaling operation has been carried out, the values are then rounded to the nearest E12 preferred value.

I feel that it is important to use a low noise op-amp in the pre-amp, and in fact in any audio amplifier in the signal path. it is pointless dragging in low level RF signals and filtering out the surrounding interference just to add noise unnecessarily close to the speaker output. So please don't use that 741 you have lying around, go for something like a TL071 which is designed for low noise applications and costs very little. Using a LM386 as the power amp, rather than the good old LM380, also reduces noise. It would be interesting to hear about members attempts to reduce noise in audio stages.

Incidentally, this pre-amp and filter arrangement can also be used with the LM1496 type mixer. This also has two outputs, which should be connected to the op-amp in the same way as pins 4 and 5 of the NE602.

Reference 1: Elliptic lowpass audio filter design using miniature preferred value components. S. Niewiadomski. Radio Communication, October 1984.

Reference 2: Passive audio filter design. S. Niewiadomski. Ham Radio Magazine (US) September, October 1985, January 1986.

Reference 3: Filter Handbook: a practical design guide.
S. Niewiadomski. Heinemann Newnes, 1989.

AN SMD IAMBIC KEYER SYSTEM (PART 2)

The Iambic Keyer Board

Bill Mooney G3VZU

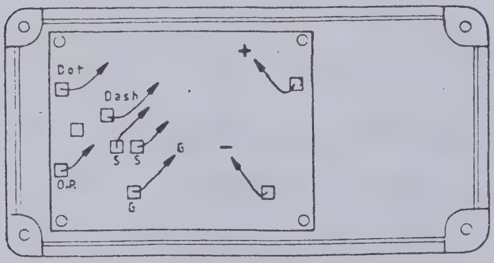
The keyer follows the circuit offered by G4ZQK in a previous SPRAT and will give full IAMBIC operation with positive keying output from an open collector. This is easily modified for negative keying. The unit is very small and along with the touch paddle unit can be incorporated into every rig you build. CMOS operation ensures very low current in the microamps range. In the circuit positive pull up resistors are included so that grounding the inputs will produce the required dots or dashes. It will work with all mechanical IAMBIC keyers but works very well with the capacitive touch paddle described in the last issue of SPRAT.

SETTING UP AND TESTING

Arrange to monitor the output from TR2. Its collector needs a load connection to +ve. The control input to the sidetone oscillator on the paddle PCB would provide such by way of R9. A small bulb or LED with 1k resistor would also suffice.

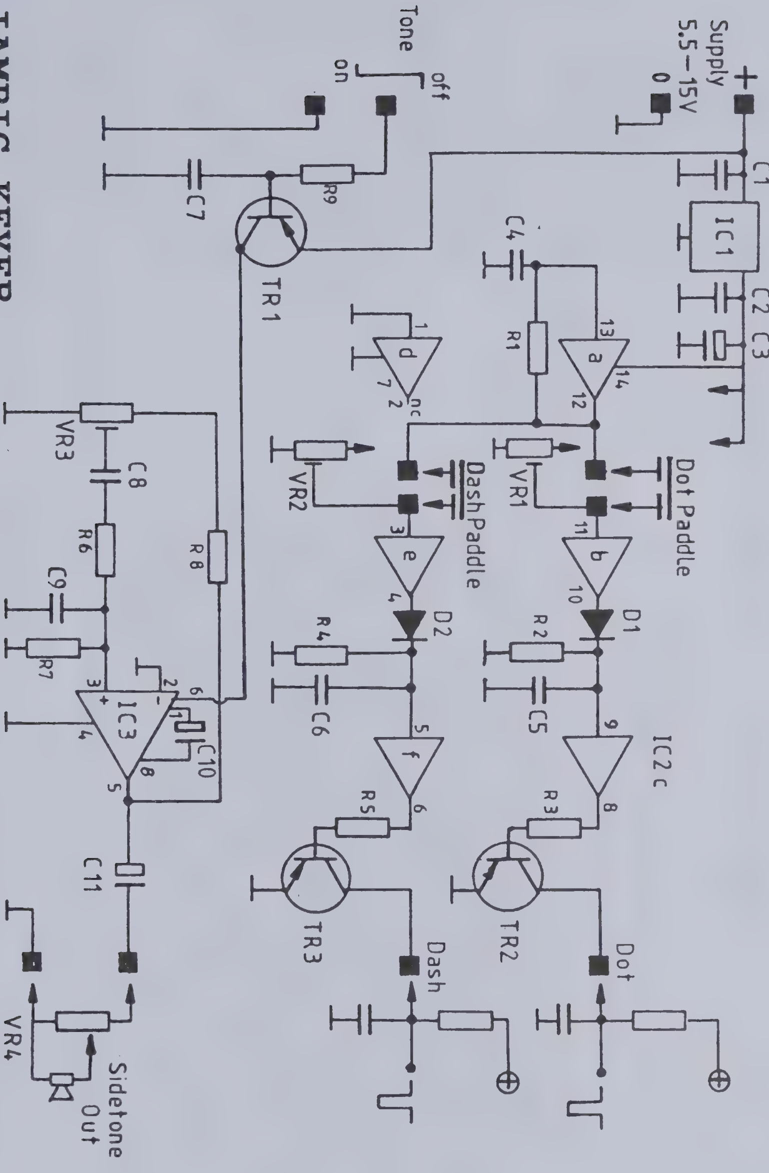
IAMBIC KEYER COMPONENT LIST

Resistors			
R1, R2, R3	100k	size	1206 chip resistor
R4	10k		1206 chip resistor
R5	4k7		1206 chip resistor
Rx	zero ohm jumper		1206
Rxx	zero ohm jumper		1206
Capacitors			
C1, C2,	1nF	size	1206 multilayer COC Diel
C3	100nF		1206 multilayer X7R Diel
Diodes			
D1	1N4148	in	SOT23 package
Transistors			
TR1	BCW32		SOT23 NPN
TR2	BCX54		SOT23 NPN
Integrated Circuits			
IC1, IC3	4011		SO8 SMD
IC2, IC5	4027		SO8 SMD
IC4	4001		SO8 SMD

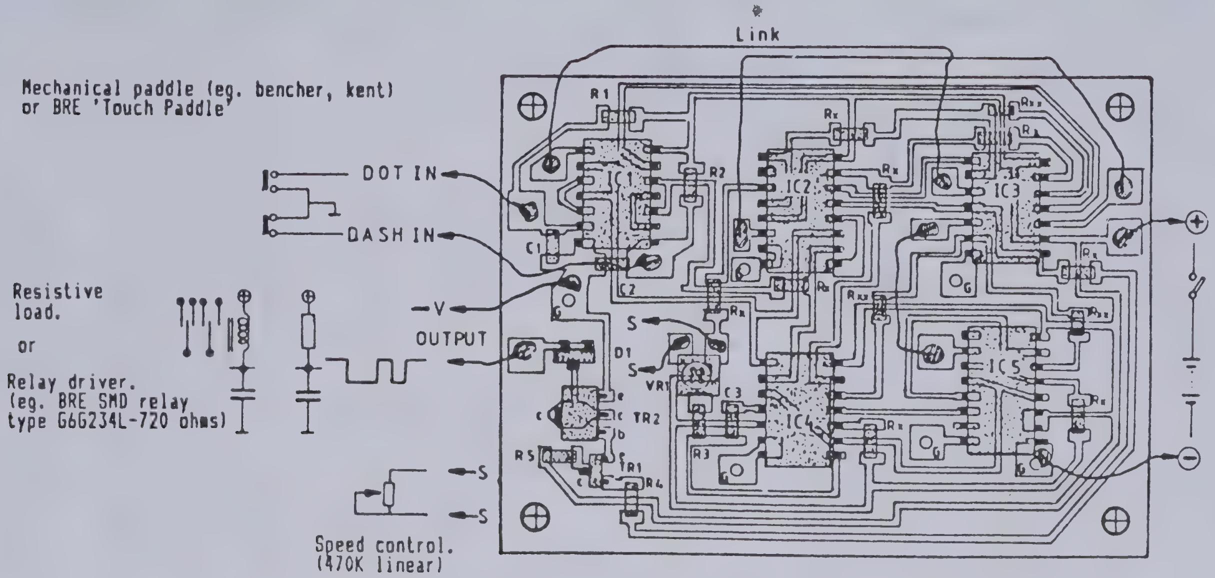


PCB MOUNTED IN LID OF BOX
See The Layout in SPRAT 62

FULL KIT OF PARTS FROM BLUE ROSE ELECTRONICS : SEE ADVERT



IAMBIC KEYER



Rx = 1206 0 ohm jumper, Rxx = 0805 0 ohm jumper.

G = Through-PCB pins, connection to rear ground plane.
(eg. Maplin FL82D)

SMD IAMBIC KEYER : PCB LAYOUT

40m VARICAP DIODE VFO

BILL BINGHAM G4WUS

This VFO is basically three bits of tried and trusted circuits assembled together.

The oscillator circuit came from Solid State Design for the Radio Amateur. The buffer amp and regulator circuit is from the Kanga gang, the varicap tuning idea came from the RC14 by S Price GW4BWE.

This circuit was up and running for less than the cost of a good quality tuning capacitor and reduction drive unit. The cost be reduced further by using two variable resistors in tandem (LIKE THE RC14) in place of the 10 turn VR1. The output is about 4v P/P.

I have this VFO in my home brew 40M TX and its stability is very respectable. I would be interested to hear your views on the above.

SEMICONDUCTORS

TR1, TR2	J310	
TR3, TR4	BC183	
D1	BB204B	
D2,4,5	IN4148	
D3	BB109	
REG1	78L05	
REG2	7808	OPTIONAL

RESISTORS

100 OHMS	R3.4.9	
330 OHMS	R5	
1K OHMS	R8	
4.7K OHMS	R6 adjust for o/p	
10K HOMS	R10	
100K OHMS	R1,2,7,11,12,13,14	
VR1	2K OHMS	10 TURN
VR2,3	2.2K OHMS	Preset
VR4	220 OHMS	Preset
VR5	47K OHMS	Preset

CAPACITORS

Polystyrene/Silver mica

10pF	C19
33pF	C6
100pF	C12
220pF	C4,5 (see table)

CERAMIC

.0047uF	C9
.01uF	C7,8,13,14,15,16,17, and 18
.047uF	C20
.1uF	C10,11,(C21,22 optional)

C1,2,3 see table

INDUCTORS

L1 see table

100uH L2,3

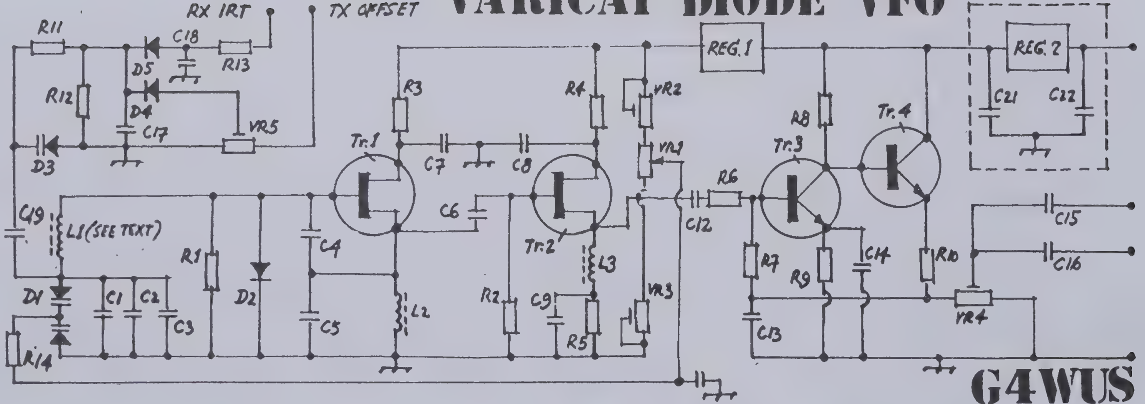
DOUBLE SIDED PCB

100mm x 60mm

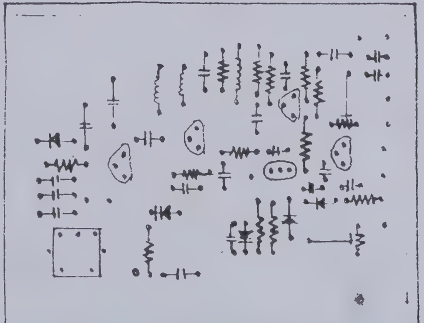
Band	C1/C2/C3	C4,5	L1
160	200oF	1000pF	Toko 3333
80	75pF	1000pF	Toko 3333
40	100pF	560pF	Toko KXNK 4173 AO
30	80pF	560pF	Toko 3335

CT = 40% C1, 40% C2, 20% C3 (Silver mica, polystyrene, NPO CERAMIC)

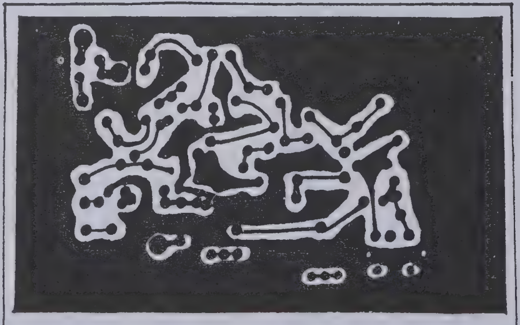
VARICAP DIODE VFO



G4WUS



PCB. COMPONENTS SIDE —



PCB. COPPER SIDE —

A TWO ELEMENT 50mHZ BEAM

BRIAN BOOTH G3SYC

For the past three years, the consuming amateur radio interest has been 50 MHz. As the 50 MHz equipment centered about a Yaesu FT690/2 some portable operation seemed natural. However on the occasions when such activity was undertaken the antenna system used was a dipole. Whilst useful contacts resulted antenna limitations and indifferent conditions did not give especially memorable experiences. This spring renewed interest in /P required that a better system be provided.

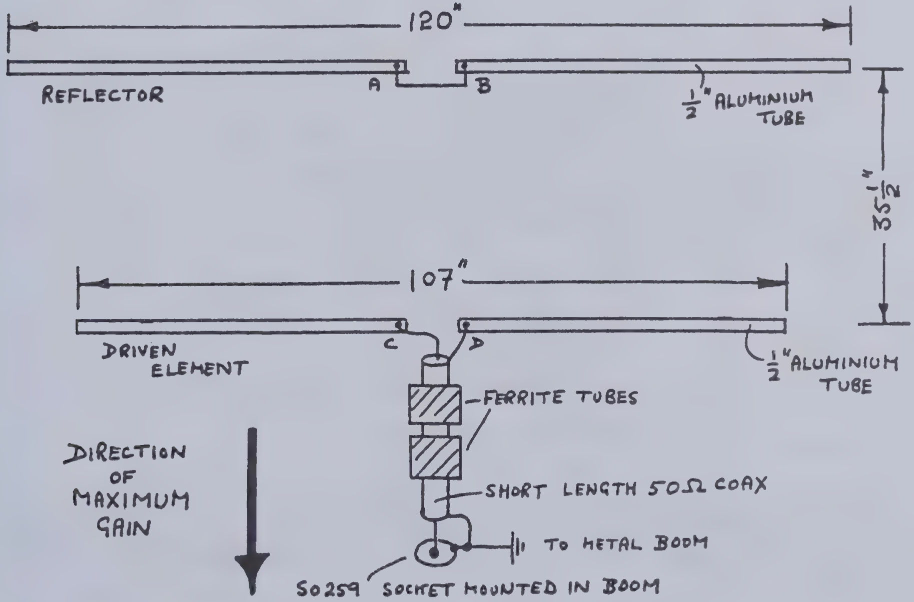
The following needs were to be satisfied:

1. Useful gain.
2. Reasonable back to front ratio.
3. Good matching to 50 ohm coaxial feeder.

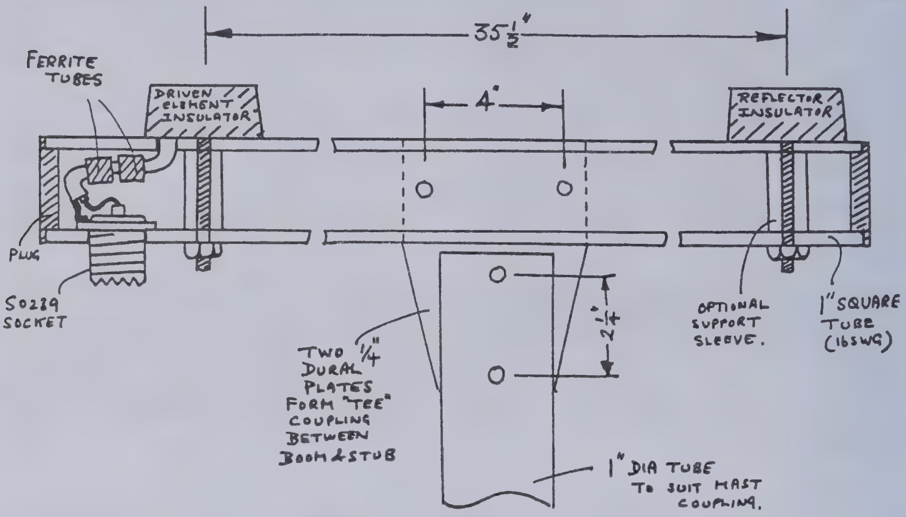
4. Easy to erect etc. and robust.

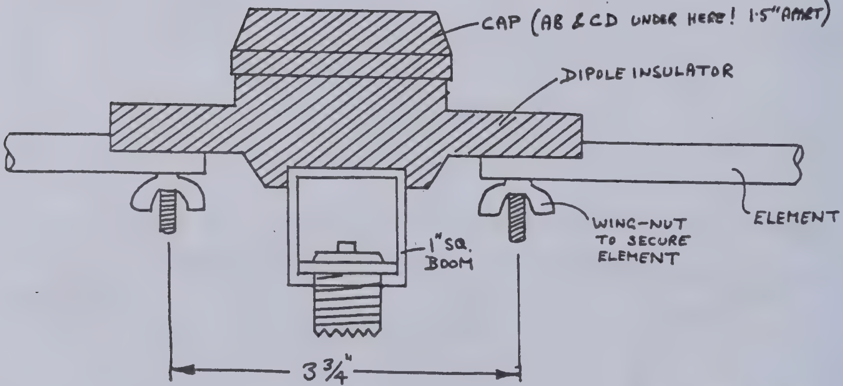
The resulting two element parasitic beam is considered to meet the above requirements rather well. Its performance literally in the field has been pleasing.

Construction was based on generally easily available plastic dipole centres and aluminium tubing procured from the usual sources. The diagrams with this text are intended to be more or less self explanatory and where necessary further comment is provided. Plumber's delight construction is avoided by the already mentioned plastic dipole centres for both the driven element and the reflector to suit item four above and in the authors case, patently better performance.



AB and CD represent the gaps in the centre of each element (1.5 inch) due to the insulators. In the case of AB this is bridged by a piece of brass strip, CD being connected to a short piece of 50 ohm coax. This latter item being threaded through ferrite tubes to form a sleeve balun. The other end of the coax being terminated at a SO239 socket mounted in the metal boom (1 inch square tube) near the driven element. The ferrite tubes were of unknown origin but they had been used for the same function on some salvaged UHF cables. The holes through the tubes were such that the "stripped" braid just fitted comfortably.




CAP (AB & CD UNDER HERE! 1·5" APART)
DIPOLE INSULATOR
ELEMENT
WING-NUT TO SECURE ELEMENT
1" SQ. BOOM
3¾"

The boom was connected to its mast with the aid of a short tubular section using two dural plates and suitable bolts. The removal of one bolt allows the tubular section to be folded along the boom helping storage. The reader will have to devise a suitable transition to the mast to be used.

Wing nuts provide easy assembly/knock down features. When folded with elements left on the insulators the overall length measured 75 inches. Aluminium plugs were provided at the inboard end of each element to prevent crushing upon tightening the wing nuts, the plugs being secured by a smear of Araldite adhesive.

An initial test with G3KNU showed an excellent match to the feeder plus a substantial back to front ratio. The physical removal of the reflector leaving it as a dipole only, indicated a very respectable gain for the beam.

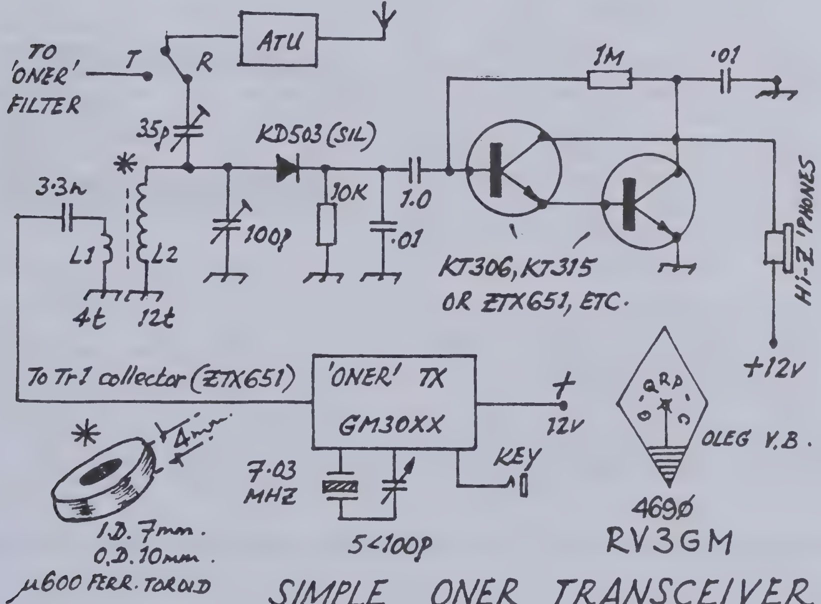
Further field experience with this beam and powers from 0.25 to 10 watts has been interesting and quite rewarding. Many European countries have been very easy to work at excellent signal strengths. A sceptical G4HBA was persuaded to take a second version of this antenna to his new QTH in Devon to provide some continuity to his 6m. activity. With this beam at low height, one of his first contacts was with Z23JO.

In conclusion it would appear that quite a useful portable beam has resulted. The original aims have been very substantially realised not the least being portability and robustness. This beam is worthy of consideration by intending /P operators.

SIMPLE 40 METER ONER TRANSCEIVER

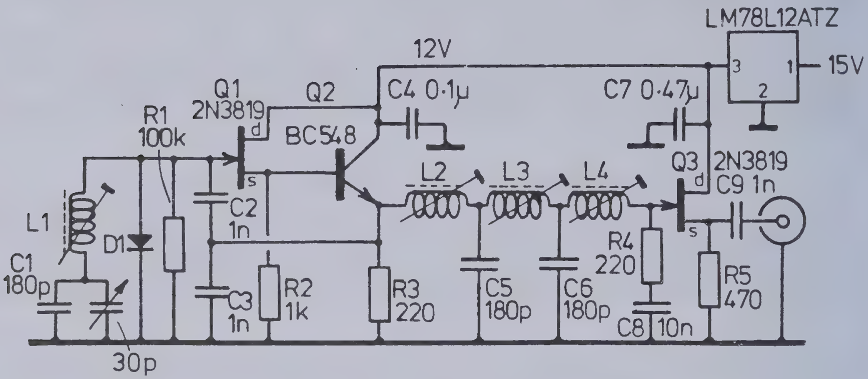
OLEG BORODIN RV3GM

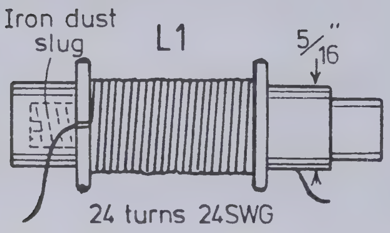
A very simple transceiver built around the famous GM3OXX "ONER" transmitter design. In the RV3GM version L1 and L2 were wound on a ferrite former as shown. This simple circuit has worked all over Europe on 40 metres.



SIMPLE ONER TRANSCEIVER

A Low Drift, Low Distortion VFO. John R Hey G3TDZ

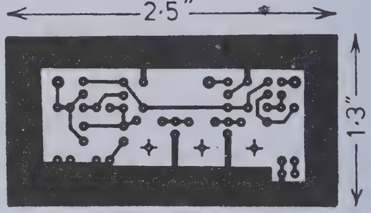




Coil former from old CTV convergence PC board.

Low pass filter coils 5mm or 3/16" formers.

L2, L4 5µH 33t 40SWG
L3 10µH 47t 40SWG



With the values shown, the VFO can be used at the popular 5MHz to 5·5MHz for mixing with a 9MHz SSB exciter, or at 6 – 6·5MHz for use with the White Rose exciter. With a couple more turns on L1, and C1 increased to 270p, ideal drive for 3·5MHz CW is achieved.

C1	180p polystyrene.
C2, C3	1n COG or X7R multilayer.
C4	100n polyester.
C5, C6	180p ceramic plate.
C7	470n polyester min.
C8	10n cer. disc.
C9	1000p med. k ceramic.

The low pass filter ensures a clean and green output for mixing.
Usual instructions regarding solid construction apply.
Prototype has built-in power supply: 12V 6W xfmr, 1A bridge, 2200µ 25V elect.

COMING IN THE NEXT ISSUE : THE WHITE ROSE TRANSMITTER WITH PCB OFFER

THE ASP CW TRANSCEIVER FOR 7MHz

Frank Lee G3YCC

Introduction

Some years ago I described a 14MHz CW superhet transceiver (Sprat Number 21 and subsequently 73 Magazine) which used a valve PA. Recently a local QRPer suggested this could be updated, so some thought was given to redesigning it for 7MHz, arguably the most popular band for QRP CW. It was to be all solid state, key operated and have an output in the region of 2/3 watts.

Having a fairly deep junk box - partly due to numerous failed project! it was decided to make maximum use of components to hand and not purchase anything if possible. Actually one varicap diode was bought specifically for this project. Hence the Asp, short for All Spare Parts, was conceived. The Mac Sprat brigade would be proud of this! Particular attention was paid to providing an efficient receiver section and this was achieved, providing a sensitive, selective and relatively quiet unit. In fact I would go so far as to say that the receiver out performs some commercial ones.

An IF of 9MHz was determined on with a VFO frequency of 2MHz, ensuring a stable frequency. Neither AVC or an S-meter are included.
The author prefers modular construction so that each section can be built separately, tested and substitutes tried, if necessary. The units are also easily serviced, by this method of construction.

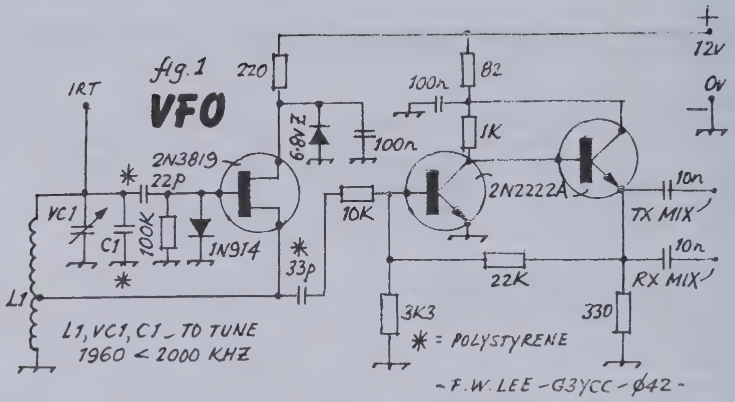
As this project was experimental and made use of materials to hand, it is not envisaged that many would attempt to faithfully reproduce all of it, nor are printed circuit boards available. Each section will be described separately. The individual constructor could adapt any of the ideas mentioned here, or incorporate his/her own designs. The receive section is also worthwhile considering as a project on its own, if required. The designs could of course be re-designed for any band, with the appropriate changes to tuned circuits etc. Coil details are not given, as these will depend on the formers used. I pressed some old IF coil formers into service and GDO'd them to frequency. No doubt would be constructors would find their own suitable formers, or, perish the thought, buy some commercial coils!

The resultant transceiver has been regularly used over a period of months and has received some favourable comments and interest from several stations, so it was thought that others may find the circuitry useful. On transmit the rig only draws some 650Ma key down, which represents little power consumption so is economical to use.

1) Variable Frequency Oscillator

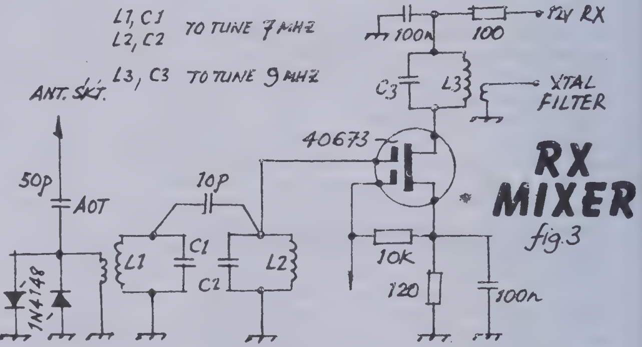
The VFO is conventional, consisting of an FET Hartley oscillator on a frequency of 2Mhz followed by a two transistor butter amplifier using 2N222A's or similar devices. Adequate isolation of the VFO is provided using this configuration, with good output level. The circuit is shown in figure 1.

The VFO is built on a PCB and housed in a die-cast box. DC leads enter the box via 1N feed-through capacitors and miniature coax route RF leads directly into the enclosure.

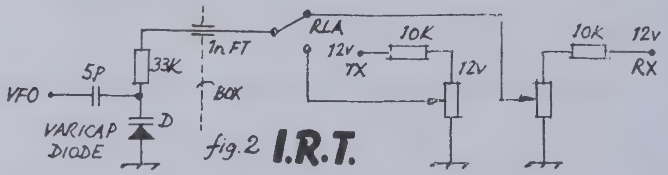


2) Receive Mixer
It had been intended to use a ring diode mixer (eg SBL-1) here, but as one was not to hand a dual gate MOSFET was used. This proved to be highly satisfactory.
Electronic switching of the antenna is provided by diodes D1, D2 and capacitor C1. Two top-coupled parallel tuned circuits constitute a band pass filter, tuned to the signal frequency as in figure 3.

The VFO signal is fed to the other gate of the MOSFET. A tuned circuit, L4 at 9MHz provides output to the filter and IF strip at 9MHz via a link coupling.
No RF stage is used or required and would probably detract from the performance of the receiver front end circuitry.



3) Incremental Receiver Tuning
IRT is considered a necessary requirement for comfortable reception and uses a well tried circuit. It is recommended that a proper varicap diode be used for stable operation, but if a junk-box diode is used, it is worthwhile checking this does not cause excessive drift, as has been the case in my experience. The values shown give a swing of +/- 5Khz, but this may be pruned to suit, by reducing the capacitor coupling the IRT circuitry to the tuned circuit, or reducing the voltage applied to the diode. I found the IRT useful using the values shown. Hams using direct conversion transceivers have been known to call off - frequency and yet others tend to drift!
The details are in figure 2.



4) Crystal Filter

The choice here is left to the constructor, but the various possibilities include:

a A commercial 9Mhz crystal filter - the most expensive choice, but one may be available from a previous project or scrapped board. A 500Khz filter would be ideal for CW purposes. Some modifications may be needed to the circuit given in figure 4, particularly to the terminating components, to suit the filter used.

b A ladder filter on 9 Mhz - there have been several circuits published using this approach.

c A Home made crystal filter - used by the author, from yet another previous rig. Although designed for SSB, this proved satisfactory. It is a double half lattice design and is described in figure 4. It could be reproduced using readily available sideband crystals.

XTAL FILTER

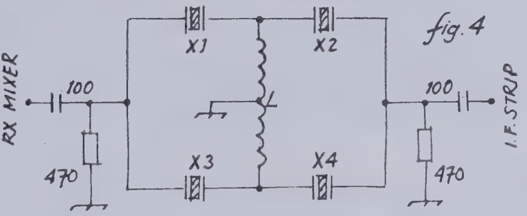


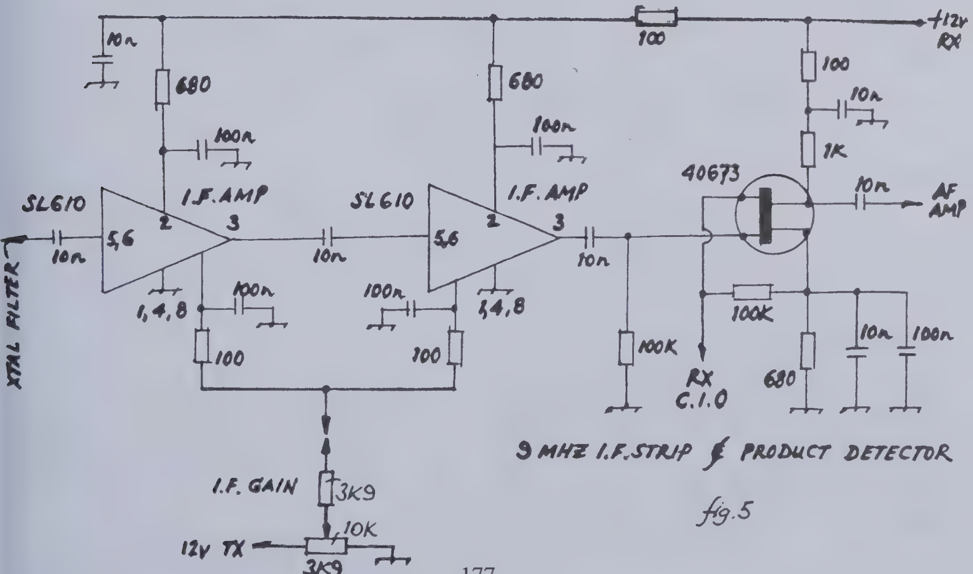
fig.4

L = 18t BIFILAR ON T50-2 TOROID
X1,3 = 8998KHZ X2,X4 = 9001KHZ

Receive IF and Product Detector

This is the heart of the receive section and is detailed in figure 5. As previously mentioned AGC is not used as it generally speaking is not particularly useful for CW work. Manual gain control if the amplifiers is controlled by varying the voltage to pin 7 of the two devices. These may be the older metal cased versions or DIL types.

Several possibilities were considered for the product detector and the final circuit used is as shown. Yet another advantage of modular construction - if you don't like one version of a particular circuit, substitute another!



9 MHZ I.F. STRIP & PRODUCT DETECTOR

fig.5

5) Receiver Carrier Oscillator
A 2N3819 crystal oscillator is used as in figure 6. A 30pf or similar preset trimmer can be used across the crystal in the gate circuit, allowing adjustment of the frequency. In practice, this was not found necessary in the prototype.

6) Transmit Carrier Oscillator
This is a duplicate of the receiver oscillator as above.

CARRIER INSERTION OSCILLATOR

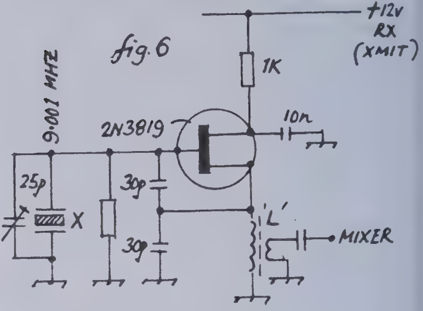


fig.6

'L' = 5t on F.8 (LINK, 2t)

7) Audio Amplifier
The audio preamp and amplifier consist of a BC107 followed by an LM386, giving adequate headphone or speaker followed by an LM386, giving adequate headphone or speaker output. Fig.7. A choke/capacitor combination can be switched across the gain control to act as an audio filter. An active device could be employed, using say one or two '741s.

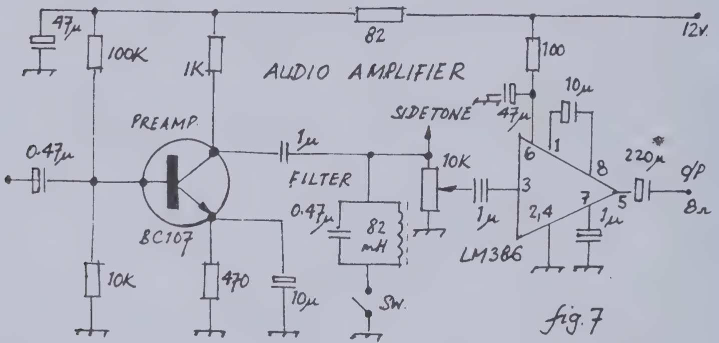


fig.7

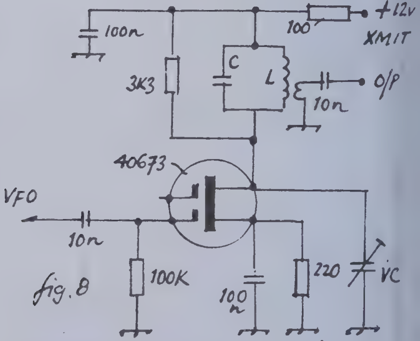


fig.8

8) Transmit Mixer
Again a 40673 dual gate MOSFET is used and the circuitry is illustrated in figure 8. The tuned circuit in the drain of the device resonates at 7Mhz, with the output link-coupled to the subsequent transmit amplifier chain.

– TRANSMIT MIXER –
(V.C., C, L + LINK O/P TO TUNE 7 MHZ)

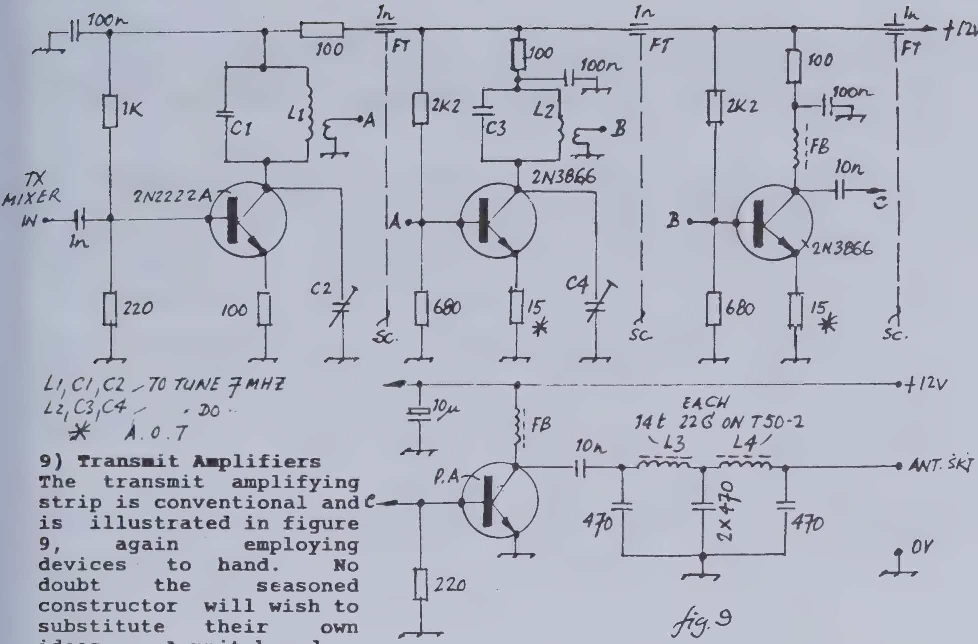


fig. 9

9) Transmit Amplifiers

The transmit amplifying strip is conventional and is illustrated in figure 9, again employing devices to hand. No doubt the seasoned constructor will wish to substitute their own ideas. A unit based on the LCK transmit section would seem suitable. The PA transistor happened to be an unmarked capstan device, apparently rated at 20W, so it easily puts out the 2-3W without hardly noticing!

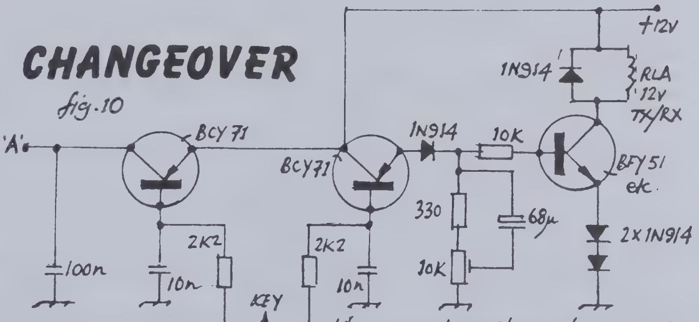
Note the use of screening between the transmit amplifiers. Generous decoupling also aids any untoward problems.

10) Change Over

The circuit in figure 10 has been in use in several projects at G3YCC and is often quoted as reliable. The preset allows a choice of delay on transmit and receive, giving Semi-breakin.

CHANGEOVER

fig. 10



'A' = KEYED O/P TO S/TONE & TX MIXER

11) Sidetone Oscillator

This consists of a multi-vibrator circuit, as in figure 11, with the output applied to the AF amplifier.

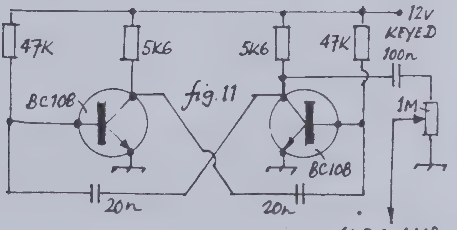


fig. 11

SIDETONE OSCILLATOR

Setting Up Procedure.

a) VFO: as usual this is adjusted using a frequency counter or calibrated general coverage receiver. A frequency of 2.0Mhz corresponds to 7.0Mhz and 1.960Mhz and 7.040Mhz - upper limit commonly used for CW.

b) IRT: my preferred method is to monitor the DC voltage applied at the F/T capacitor when the IRT 10K pot is mid-travel and adjust the pre-set potentiometer, so that when in transmit mode, the voltage at the F/T is the same as when on receive. This is best done with a digital voltmeter for accuracy. A final check can be made on-air. Alternately, comparison of the transmit and receive frequencies can be made with an existing transceiver, using zero-beat as the reference.

c) Transmit strip: here a receiver and calibrated wavemeter are required to ensure the tuned circuits are adjusted to the the correct frequency, as it is very easy to tune to the wrong one, especially with such a low frequency VFO. Of course, tuning-up in done with a dummy load connected to the antenna socket, preferably with a suitable incorporated wattmeter to monitor the power output.

As the rig is economical in power consumption, it would be ideal for portable use. The prototype has certainly proved successful at my QTH and is a joy to use.

THE G3MY VFO

Mike King G3MY

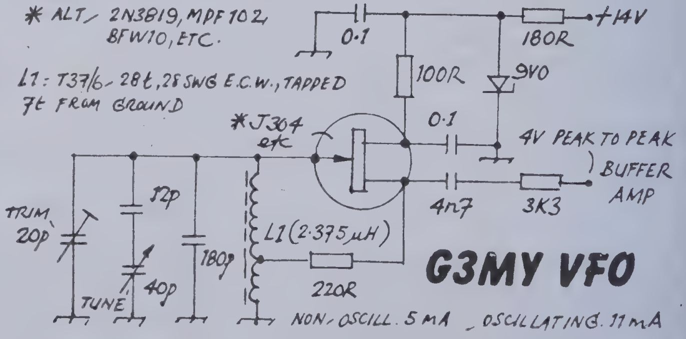
This VFO which is perhaps new and unique. All I can say is that for me, it replaces all conventional VFO's be they Hartley Colpitts, Seiler or Cackar.

I developed it in the mid sixties for use as the remote VFO of a home made mobile SSB transceiver where it performs with great success and stability.

Recently, I have brought it up to date and miniaturised it to use in a small QRP transceiver and it is now using a Toroid wound coil (in this rig a T37/6 toroid on 7MHz.

It is impossible to make a VFO with fewer components and at the same time, such a good performance.

I use a J304 FET with 9 volts stabilised on the drain. On 7 MHz the output is 4v pk. and this is coupled into a two transistor feedback isolator amplifier which in turn drives a VNIOKM to around 3 watts output.



It certainly won't take you very long to put one together to give it a try!

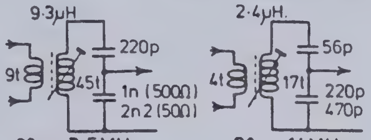
The White Rose Transmitter

A Companion for the White Rose receiver, by John R Hey G3TDZ.

The exciter.

Designed to work in conjunction with the White Rose receiver and taking its drive from the VFO at 6 - 6·5MHz., and from the converters' crystal oscillator chain, output is accurately tuned to received frequency. Employing the phasing method, no expensive filters and matched crystals are necessary; neither are tuning gangs or slow motion drives; industry standard components are used throughout.

The exciter will drive a selection of 4Watt plug-in power amplifiers, to be described later, or alternatively the Cirkit linear amp, or other designs. The exciter can also operate at other frequencies such as the popular 5MHz./9MHz. combination. With a 5 - 5·5MHz VFO fed into the VFO inlet and a 9MHz crystal oscillator fed into its input via C29, it will be necessary to alter the RF phasing by making R34 and R32 both 270Ω. The VFO could be fed to the crystal input and the crystal to the VFO input for reduced phase error: here R32 and R34 become 120Ω and R33 and R35 56Ω; this also necessitates changing the low pass filter. It will be shown later how T2, L1, L2, L3, C33 and C34 may be replaced by a single tuned circuit.



80m 3·5MHz. 20m 14MHz.

Typical band selection circuits.

Circuit description

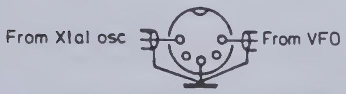
U1a microphone amplifier feeds a 3rd order Butterworth low-pass filter U1b via the limiting diodes D1,D2; these define the maximum output signal, rather than be used for speech clipping, obviating the need for difficult ALC circuits later. C1 is chosen for LF roll-off below 250Hz., and the filter prevents out of bands clipping products.
The 90° audio phase shift network R15 - R24 must use 1% resistors and C6 - C9, polystyrene types, and be driven in push-pull with a ratio of 3·5:1; U1c furnishes these requirements; section U1d provides a mid-rail reference or bias for the other three sections.

Phase shift networks must look into high resistances: U2a and b buffer these, with R25 and VR1 enabling equal drives to the two balanced modulators. Changing over the two audio drives A and B cause the other sideband to be generated.

The 6 - 6·5MHz. VFO waveform from the receiver is amplified by Q1; T1 drives RF 90° phase shift network R32 - R35, C16 and C17, then coupled into the two 1496 balanced modulators. VR2 and VR4 are carrier balance controls; VR3 equalises gain slope characteristics.

T2 combines the signals which now form a single sideband, a low-pass filter removes any rubbish. The SSB is now converted to the desired band in the high level mixer U5 by mixing with the receiver's crystal oscillator waveform.

A tuned circuit should be wired between the high level mixer and linear amplifier. The plug-in power modules have this tuned circuit as well as an output low-pass filter on board to avoid band switching at high signal levels.



5 pin audio locking DIN
Type FE47
Plugs FE46

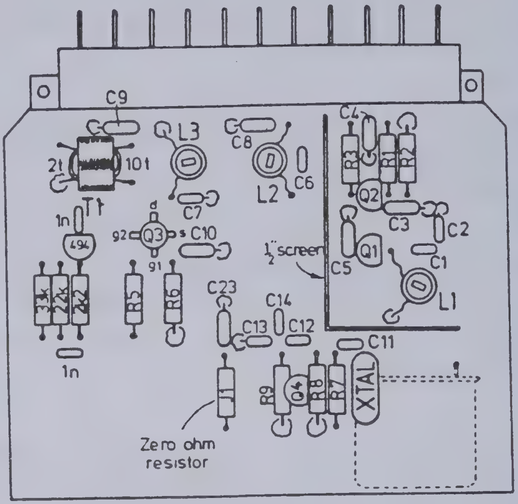
THE WHITE ROSE SSB EXCITER PRINTED CIRCUIT BOARDS : £3.75 inc postage
Dave Aizlewood, G4WZV, 36 King Street, Winterton, Scunthorpe, DN15 9TP
Still Available: WHITE ROSE RECEIVER PRINTED CIRCUIT BOARDS:
MAIN BOARD : £2.50 inc postage. CONVERTER BOARDS : £1.25 inc postage.
Please make out all cheques to "G QRP CLUB" and quote membership No.

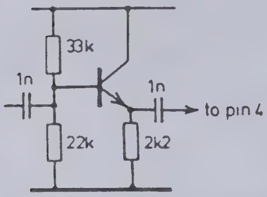
Preparing the receiver

If you haven't already done so, fit a suitable 5 pin socket to the rear panel; a 5 pin locking DIN is a good choice. The chassis drawings show dimensions. Connect with miniature coax one terminal to the VFO outlet wiring pin; outer to earth foil. Similarly connect the other pin to the converter edge socket pin 4; outer braid to pin 5, keeping pigtails short - say 1cm. At the DIN socket, common the two earth braids to the centre pin and earth tag. This will be copied at the transmitter. Make up a twin coax leud about 15" long. FE46 plugs, and two plain wires.

Preparing the converters

Unused holes and track will have been noticed. As shown, fit an RF transistor with its bias resistors; a BF494 or similar type is suitable. A 1n feeds its base from the mixer injection bus, and another 1n feeds the output to pin 4 of the DIN41617 edge connector.





Now your transmitter has all its oscillatory drive requirements.

Caution!

All is not yet well. On 80m, at 3·75MHz. the VFO is at 6·25MHz, and the square root of that is 2·5MHz.; all Hell breaks loose. Sorry chaps, the crystal must be changed to 10MHz., C12 becomes 120p and C13 180p. The tuning scale now reads in reverse and you must switch to USB.

On 40m, with a 1MHz crystal, the situation is much worse. Change the crystal to 13·5MHz (or 13·3MHz to centralise the tuning scale); C12 becomes 100p and C13 150p; again select USB.

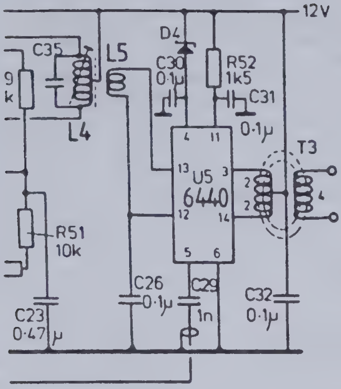
20m, 15m and 10m all seem to be clear: an 8th harmonic on 6m should not be troublesome, but 18MHz and 25MHz are dead ducks due to low direct harmonics.

Construction

No special skills or techniques are required in building the exciter board. Use metal film resistors; see parts list for recommended capacitors.

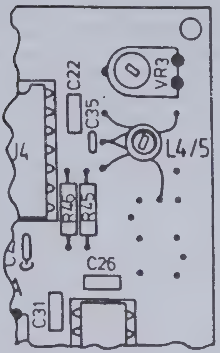
Where tracks appear to require soldering on the upper surface, only at resistors should this be done. DO NOT attempt to solder to pads which occur under polyester capacitors or IC sockets; there is always a nearby resistor where this is easy. There are only two exceptions: C18 and C19, both disc ceramics. Two trackpins link upper and lower tracks: these are hidden under U3 and U4 sockets; a third trackpin is next to U4, C22.

A low-pass filter is shown in the circuit diagram consisting L1, L2, L3, C33 and C34. L1 and L3 are 11·5μ and L2 23μH. Ready wound inductors having wire ends, of 12μH and 22μH can be bought from Cirkit and Bonex. However a simpler solution has been provided on the PC board: T2, L1, L2, L3, C33, and C34 may all be replaced by a single tuned circuit, L4, C35.



Detail showing T2 and low-pass filter replaced by tuned circuit L4, L5, C35.

L4 14t bifillar 32-36 SWG; L5 10t 30SWG over L4. C35 120p.



L4 is wound with 14 bifillar turns, 28t in fact, 32 to 36SWG; this enables a good and easier centre tap to be made. The resonating capacitor is 120p. Coupling to U5 is by a 10 turn link of 30 gauge wound on top of L4. Transformers T1 T3 use two FX1115 ferrite beads.

Mechanical

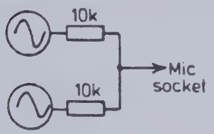
The exciter board measures 3″x 4″. Allow similar space for power board and fit a metal screen between. On your front panel provide a 4 pin mic. socket, a key jack, a miniature DPDT switch for sideband selection, a SP on/off for tune and CW transmit, and a 500mA or 1A panel meter. A red LED wired in series with the relay indicates transmission. Three supply spigots enable easy connection to 12V supply, relay coil, and PA meter.

Keep pigtails short and include a ferrite bead on the mic lead inner. A 12V relay will be used for aerial switching and receiver muting.

On your rear panel provide for an SO239 (UHF) aerial socket, a BNC socket for receiver link, a 5 pin locking DIN, a 2 pin socket of your choice for receiver muting or linear amp signalling, and power input terminals. (12V at 1A)

Alignment

Temporarily remove U5. Apply power - no smoke - good, carry on. Connect receiver drive cable and tune to mid band, osc drive at 6·25MHz. Adjust VR1 and VR3 to mid travel. Place oscilloscope probe between earth and U5 pin 13, sensitivity 100mV/div., timebase any speed. A broad RF trace should be seen. Adjust VR2 for minimum. If L4 is fitted, tune this for maximum first. Now adjust VR4 for minimum amplitude. Increase Y sensitivity to 50mV or even 20mV/div. and readjust both VR2 and VR4 for minimum, now reduced hopefully to only a line. Repeat if necessary.



Switch up Y sens. to 100mV/div., and apply an audio tone of 1kHz at a few mV to the mic. socket. An RF sinewave should now be seen. Increase audio level until limiting is obvious, then back off to about 3/4 amplitude. With the timebase set at a low speed, suitable for the audio component, you will see the broad band of RF with a ripple of LF along top and bottom edges. If this ripple is bad enough, the 'scope can be synchronised onto it. With the timebase at high speed and synchronised to the RF wave, the sine wave displayed will show thickening at top and bottom of its peaks. In both cases, ripple is due to the unwanted sideband. Adjust both VR1 and VR3 for minimum ripple. Apply now a two-tone oscillator or two low distortion AF generators via the network shown. Careful control of their amplitudes should result in a characteristic SSB waveform being displayed; again VR1 and VR3 may be adusted for minimum ripple or fuzz. Operation of the sideband switch should show little or no difference.

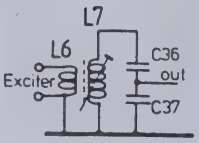
WHICH SIDEBAND? In place of the 'scope, hitch a frequency counter, and feed one audio signal. If the count increases as the audio frequency is increased, you have upper sideband; turn the switch and see what happens.

Refit U5 and slot in your favourite updated receiver converter, say 80m. Connect 'scope to output spigots, Y sensitivity 0·5 or 1V/div., and apply two tone test signal. A larger SSB waveform will be seen, though a little fuzzy; the following tuned circuit will clean it up nicely.

Plug in your microphone. If only modest speech causes flat topping, reduce value of R2; a low impedance mic. might require more gain; R2 may be increased to 1MΩ.

Interfacing to Cirkit power amp.

A tuned cct. (band selection) is required:



	L7	L6	C36	C37
160m	63t 40g	7t 30g	390p	3n3 Cirkit amp doesn't work on 1·8MHz.!
80m	44t 40g	5t 30g	220p	1n8
40m	31t 36g	4t 30g	120p	1000p
30m	Wot, no SSB!			
20m	22t 30g	3t 28g	56p	470p
15m	14t 28g	2t 26g	39p	330p
10m	12t 26g	1t 24g	27p	220p

All coils close wound on 3/16" or 5mm formers.
18 and 25MHz., see earlier note.

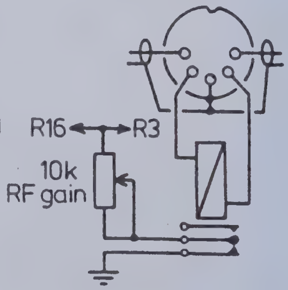
Parts List

R1	100k
R2	390k
R3	47k
R4	2k2
R5, R6, R7, R8, R9, R10	6k8
R11, R42, R43, R50, R51	10k
R12, R26, R27	15k
R13	20k 1%
R14, R28	8k2
R15	430k 1%
R16	56k 1%
R17	1k5 1%
R18, R19	220k 1%
R20	330k 1%
R21	110k 1%
R22	15k 1%
R23	18k 1%
R24	180k 1%
R25, R36, R44	1k
R29	3k3
R30	68
R31, R32, R34	220
R33, R35	33
R37, R38, R45, R46	560
R39, R47	22k
R40, R41, R48, R49	27k
R52	1k5

C1	15n Wima MKS2
C2, C3	22n Dub. MMP
C4	1500p Wima FKP2
C5	330p Wima FKP2
C6, R8	680p polystyrene
C7, C9	430p polystyrene
C10, C11	10μ tant.
C12	47μ 10V elect.
C13, C29	1n ceramic
C14, C15, C18, C19	10n cer. disc.
C16, C33, C34	100p cer. plate
C17, C35	120p cer. plate
C20, C22, C24, C25, C26, C30, C31, C32	0·1μ Wima MKS 2
C21, C23	0·47μ mono.
VR1, VR3	2k2 horiz. cermet.
VR2, VR4	50k 3/8" multiturn

U1	LM348N
U2	LF353N
U3, U4	1496
U5	SL6440
Q1	BC548
D1, D2	1N4148
D3	BZX79C7V5
D4	BZX79C2V7

It is essential to mute the receiver to avoid oscillator pulling



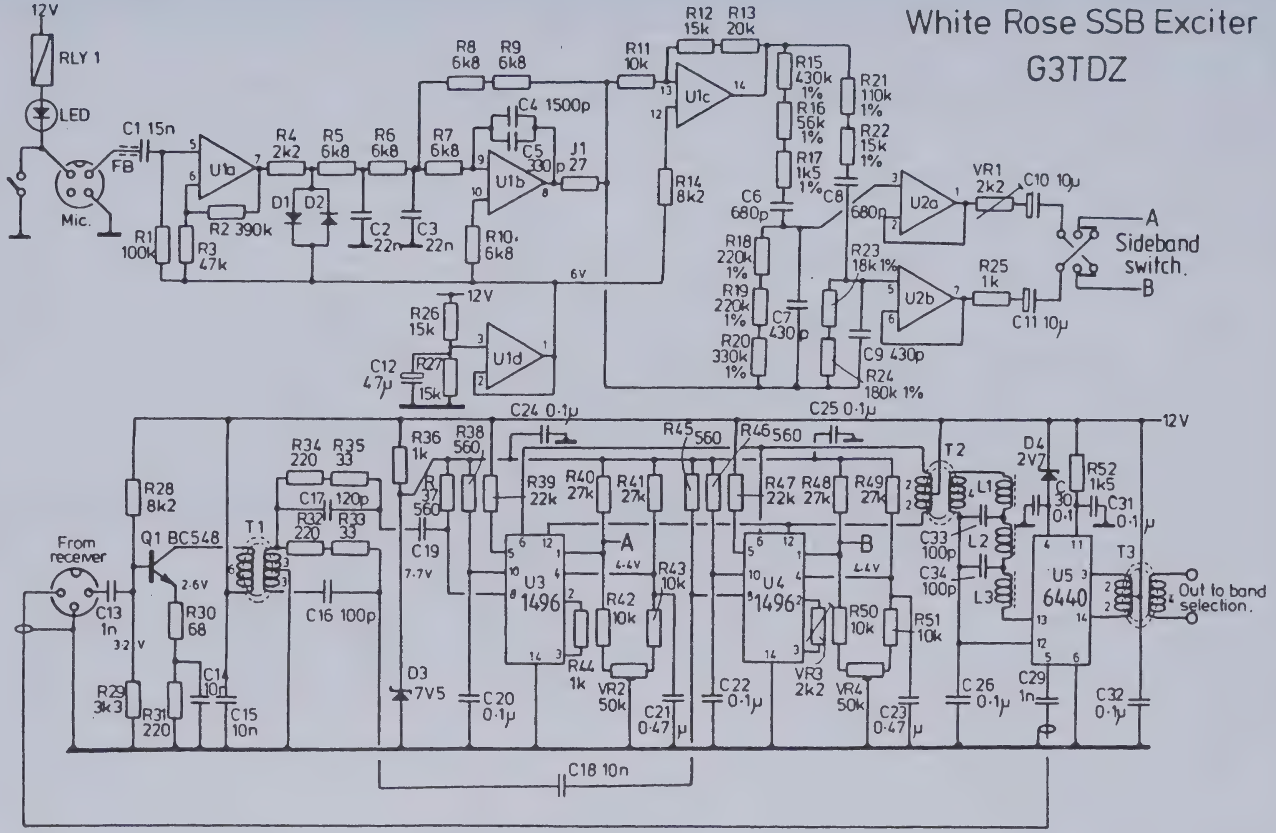

White Rose SSB Exciter
G3TDZ

Fig. 1.

White Rose SSB Exciter pcb component plan. G3TDZ.

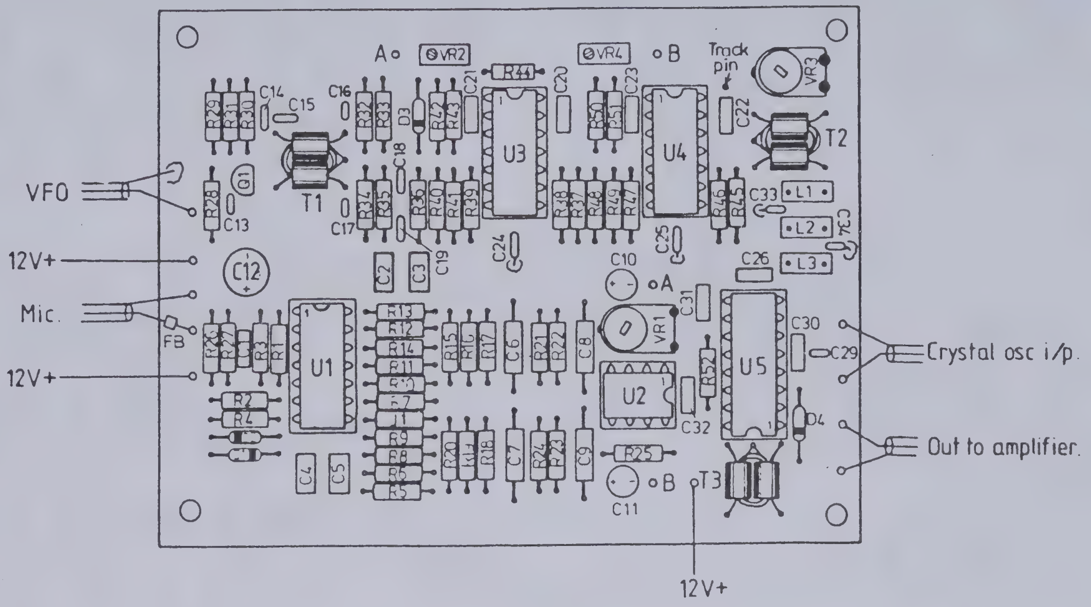


Fig. 2.

DC RX = Double Conversion RX

Ian Macpherson GM3RXU

Many of the receiver circuits published in SPRAT and other journals for simple home construction are based on Direct conversion designs. Some of these, such as the Sudden, can give excellent results and are easy to adjust and set up. They all, however, suffer from the same potential deficiencies although some of these can be minimised with good design:

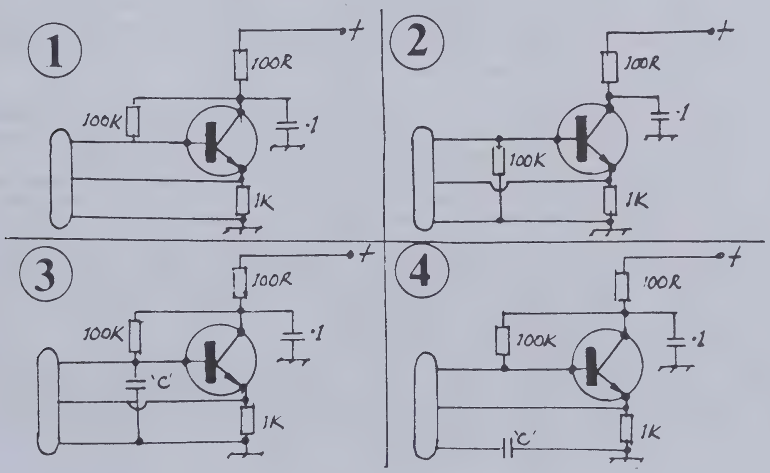
- AM breakthrough can be greatly reduced or eliminated by the use of balanced detectors.
- Selectivity can be improved by the use of AF filters after the detectors.

Without the use of rather complex phasing techniques, however, DC (direct conversion) designs do not allow "single signal" reception. The audio image is always present along with the desired signal and on a busy band this can have the effect of making the band seem doubly busy.

The use of a conventional superhet with a reasonably sharp filter at 455 KHz can provide single signal reception but the low IF allows RF image breakthough with signals of 7 KHz and above unless a good RF filter is incorporated ahead of the mixer. Designs such as the LCK avoid this problem by using a high IF built around a crystal ladder filter to give good selectivity. Such designs can give excellent single band CW performance but the design and construction of a crystal ladder filter may put some people off (unnecessarily) and certainly getting a good flat passband for SSB reception can be a bit tricky.

There is an alternative design which is not often seen in home construction articles. This is the double conversion technique and was used in some of the later valve receivers such as the YEASU FR50B and the EDDYSTONE 888. Such designs offer the use of conventional 455 KHz filters while at the same time a first IF which is sufficiently high to avoid RF image problems. Nothing comes free, however, and some care is required with the design to avoid "birdies".

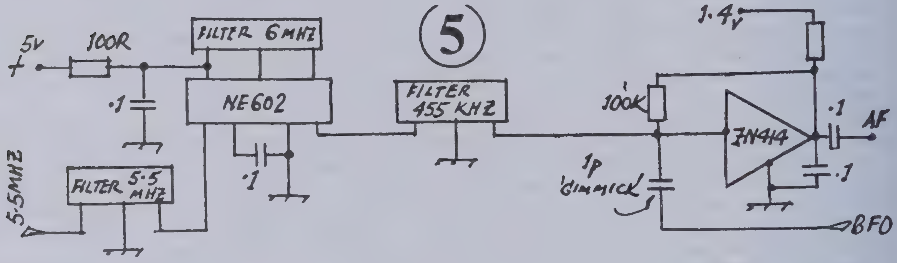
Anyone interested in the design of amateur equipment should always keep an eye open for the availability of new and useful mass produced items. In this context, the ceramic filters used in TV sets to give IFs of 6 MHz and 5.5 MHz have some interesting properties from an amateur point of view. They can be used, for example as the frequency determining elements in oscillators.



Figs 1 to 4 show some typical circuits. In these a 10.7 KHz filter will oscillate at about 10.8 MHz, i.e. at the upper cut-off edge of the passband. The 6.o MHz, 5.5 Mhz, 4.5 MHz and 455 KHz ceramic filters oscillate at the lower cut-off edge of the passbands, i.e. 5.91 MHz, 5.39 hz, 4.4 Mhz and 450 KHz respectively.

The frequency can be controlled by the addition of a series or parallel capacitor as in Figs 3 and 4. The typical range for a parallel capacitor would be about 15 KHz at 5.5 or 6.0 MHz. A similar similar range is possible at 455 KHz but a substantially larger capacitor is required. A series capacitor raises the frequency by a smaller amount, the limit being loss of oscillation.
The 5.9 MHz signal generated by an oscillator controlled by a 6.0 MHz ceramic filter is conveniently 455 KHz above the passband of the 5.5 MHz ceramic filter. Combining these features with the NE602 mixer-oscillator it makes the basis for a double conversion design which requires virtually no set-up adjustments.

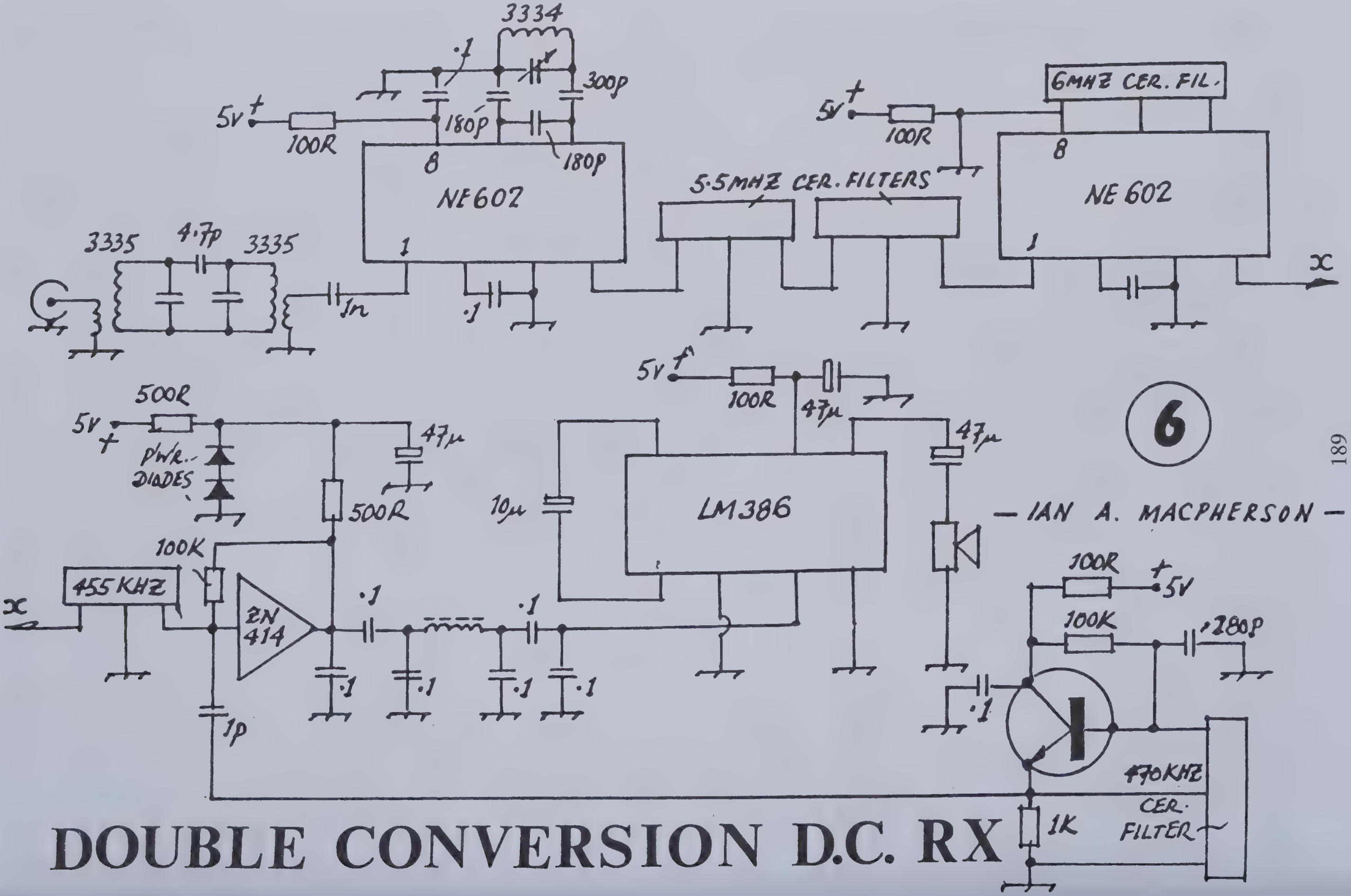
⑤



In Fig 5 the ZN414 acts as the IF amplifier at 455 KHz but also behaves as a passable product detector if the BFO injection is kept low enough to avoid triggering the AGC. The full receiver is completed with the addition of a further NE602 as the RF mixer and an LM386 as the audio output amplifier as in Fig 6.

A practical receiver for 20 meters built around these elements gives excellent results with only one small "birdie" in the RTTY section of the band. The RF coils were 3335 types and the oscillator coil a 3334 type from CIRKIT or MAPLIN. The 455 KHz filter used in the IF stage was two CFM2A455 types from CIRKIT, back to back but any narrow band AM or SSB type filter would work fine. The BFO injection was obtained from an old 470 KHz ceramic transfilter used in an oscillator circuit and padded down to the appropriate band edge with parallel capacitors.
Injection into the ZN414 depends on layout and leakage but assuming screening is good then a small "gimmick" twisted wire capacitor or about 1 to 1.5 pF will be sufficient.
The ceramic filters can be found in the catalogues from CIRKIT and MAPLIN and also from time to time in the TANDY (US Radio Shack) stores. They are inexpensive and cost about 70 to 80 pence each.
The results are well worth the effort - clean signals from a quiet background with no image problems!!

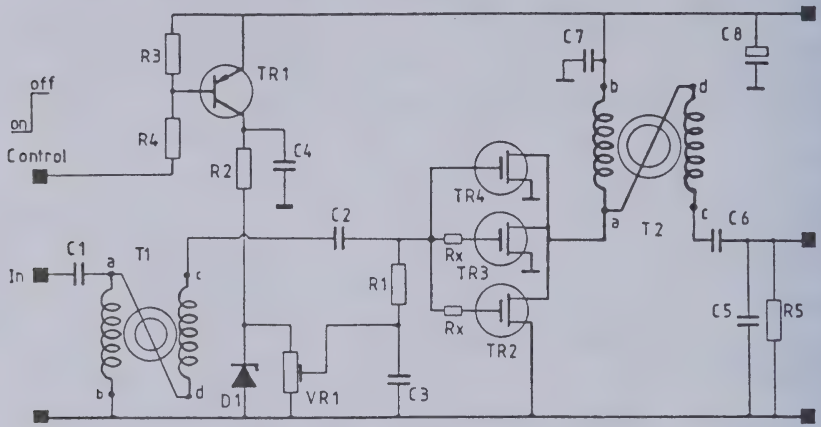
DOUBLE CONVERSION D.C. RX



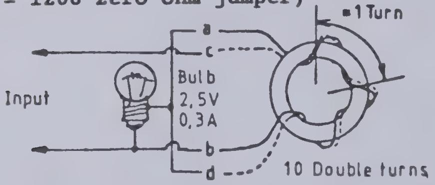
JAMBOREE QRP LINEAR AMPLIFIER

BILL MOONEY G3VZU

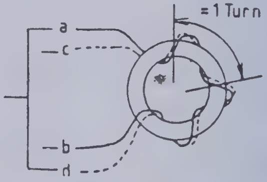
The JAMBOREE QRP linear amplifier can be used as a final output feeding an antenna via a suitable change-over relay etc. or as a driver stage to run a more powerful transmitter. It uses three 1 watt SOT89 packaged MOSFETS so that it will handle 3 watts dissipation easily. With good heatsinking this kpower can be extended with increased efficiency. The user should make some measurements and keep an eye on what power is being used.



(Rx = 1206 zero ohm jumper)



BULB DUMMY LOAD



TRANSMISSION LINE TRANSFORMERS
T1 : 14t twin 36 swg enam.
T2 : 9t twin 24 swg enam.

COMPONENT CHECK LIST

R1	820R	(821)	size 1206 chip resistor
R2	1kO	(102)	size 1206 chip resistor
R3,R4	10kO	(103)	size 1206 chip resistor
R5	4k7	(472)	size 1206 chip resistor
Rx	ORO	(000)	size 1206 zero ohm jumper
VR1	10K		Trimpot type 3315
C1,C2,C4	100nF		1206 Y5V Ceramic
C3,C7.C6	470nF		1812 Y5V Ceramic
C5	47pF		1206 COG ceramic
C8	33uf/16V		Tantalum case D
T1 - core			Type B64290 K40037 X830 6.3mm * 3.8mm (ID) *2.5mm
T2 - core			Type B64290 K40038 X830 10mm * 6.0mm (ID) * 4.0mm
D1			5V1 zener in mini MELF pack
TR1			BCW30 PNP SOT23 transistor
TR2,3,4			BST80 Power MOSFET in SOT89

160 TO 30 METRES
SMD LINEAR AMPLIFIER
50-100mW DRIVE FOR 3W IN
12 to 16v SUPPLY
NOMINAL 50 Ohm LOAD

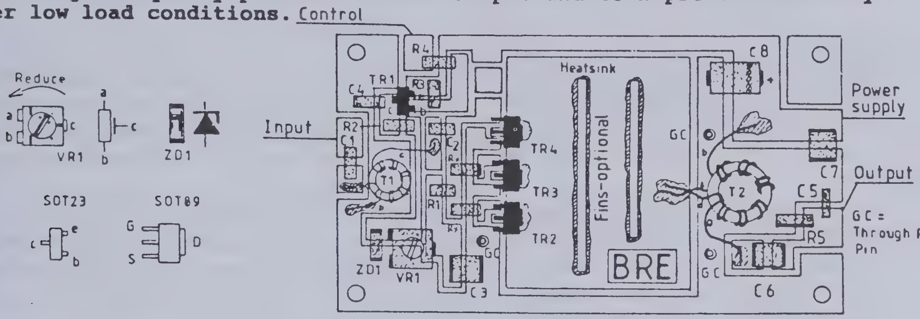
KIT AVAILABLE
BLUE ROSE ELECTRONICS
SEE ADVERT THIS ISSUE

CIRCUIT OPERATION

Input coupling makes use of a small transmission line transformer (TLT) T1, to achieve an input impedance of about 200 ohms mostly resulting from R1. C3 has a very low reactance such that the lower end of R1 is effectively at RF ground. The MOSFETS are N-channel enhancement mode types so that a forward bias is required (>2.6V) to make them conduct. This is supplied from a zener diode stabiliser D1, R2. VR1 is used to set the bias on the gates.

TR1 controls the PA by switching the bias. Turning TR1 on with a "Low" on the "Control" input thus activates the PA. A "High" or NC on the Control input results in the removal of bias and the PA is inoperable.

A high level of drive (>2.5Vpk) will defeat this bias switching arrangement. The user must therefore be able to adjust the drive level. The trimpot is a high quality robust device which will withstand a lot of tweaking. The MOSFETS are operating in parallel and therefore another TLT is needed to transform the resultant low drain impedance to a nominal 50 ohms. The cold end of this output TLT is decoupled to RF by C7. The output capacitor, C6, is also a large value, low reactance ceramic for tightest coupling. R5 and C5 serve to reduce high frequency products in the output and to improve stability under low load conditions.



GETTING IT GOING

Set the bias pot, VR1, for zero voltage to the gates - fully anti-clockwise. Apply a 12V current limited power supply. With zero bias and the "control" input "high" or NC there should be no quiescent current. Grounding the control input should result in a few mA drain due to the stabiliser. Now connect a load. A standard 50 ohm device is preferred but many QRP enthusiasts like to see the results of their labours. A small 2.5V 0.3A torch bulb connected as shown will suffice. Use the same construction as for T2. In this way the bulb resistance of about 8 ohms is transformed to about 32 ohms making a better match. Next connect a source of RF CW or SSB with some provision for amplitude adjustment. With no drive turn up the bias current to about 100 mA. The RF should now drive the current up to 400mA without excessive dissipation.

Intermittant peaks of drain current as high as 1A are possible but be careful, it is quite possible to melt the solder (180 deg C) on the output transistors. A symptom of heat damage to the MOSFET's can easily be removed with a suitable rework tip and replaced after cleaning the track with solder wick. Peaking up to 600mA with SSB should be possible. Increasing the standing bias will improve the gain and linearity but again watch the temperature. An aluminium heatsink thermally coupled to the rear tracking, avoiding the grounding pins, will help a lot. In any case make measurements and calculate the power levels you are dealing with.

If a low pass harmonic filter is being used on the output make sure it is not absorbing too much precious power. The output impedance will vary with drive levels so that the 50 ohm figure is nominal. The efficiency will be adequate for such a low power device.

A REAL QRPp VSWR Meter

Ha-Jo Brandt DJ1ZB

From ordinary VSWR meters it is well known that on a given aerial a higher VSWR is measured when using 100 watts instead of 10 watts of RF power. Therefore, to achieve correct results qrp operators should have a VSWR meter as sensitive as possible. At full sensitivity the meter described here will need less than 10 mW to reach the SET point, over the range 1.8 to 30 MHz. On the other hand, about 16 watts is the maximum permissible power, because the HPA 2800 diodes are driven to their maximum PIV ratings.

The Circuit

For better sensitivity, two current transformers are use, with 20 turns each, Their inductivity may differ, due to core tolerances, but should be about 450 uH or more. The division ratio of the capacitive divider C1/C2 is rather low and its total capacity high, to provide a low impedance source at 1.8 MHz. However, at 30 MHz this capacitance is too high to achieve a low VSWR in the 50 ohms line. This problem has been solved by incorporating this capacitance into a low pass filter with a cutoff frequency of about 40 MHz (Fig.1).

Screening

The 430 ohms load resistors across the current transformers cause a problem being not so critical with less sensitive VSWR meters having load resistors in the tens of ohms range: Stray coupling from the 50 ohms line into the diode circuit! To prevent this, the circuit diagram shows three different screened areas: (1) the 50 ohms line, (2) the area of the divided cable voltage, and (3) the area of the current transformers' output voltage.

Area 1 contains just the 50 ohms line, the current transformers T1, and the capacitors C1, C3 and C4. For the line the center conductor and insulation of a coaxial cable is used which just allows the current transofrmers to be slipped over its diameter. A screen between the transformer windings and the conductor has not been found necessary. A u-shaped metal plate acts as a screen for area 1. The leads from C1 and T1 leave this area through three holes in this metal cover.

Screening between areas 2 and 3 is not so critical. Both may be arranged on a common pcb. However, two separate metal bolts are used for grounding the current transformer leads and capacitor C2. Also, a grounded "guard ring" should be provided to separate the diode terminals belonging to either area 2 or 3 (Fig.2). The ground points for the blocking capacitors at the FWD and REF terminals are not critical. The pcb is fastened to one side of the u-shaped screen of area 1.

Alignment

A signal generator or a qrp transmitter with good harmonic suppression is needed, and 50 ohms termination. Firstly, trimmer C2 is set at 2/3 and C3 at 1/3 of full mesh. Due to the two current transformers there may be three initial states: The meter may operate right, it may operate right, but in the opposite direction, or forward and reverse indications may be equal. By reversing the polarity of one or both current transformers at "x" the correct connections must be tried out. Then C2 can be adjusted for minimum reverse indication at 14 MHz.

Then the low pass filter must be adjusted for minimum VSWR of the 50 ohms line up to 30 MHz. A sensitive VSWR meter like that to be built would be nice for this purpose (raising the old question what to be older, the hen or the egg), but normal resistive bridges are sufficiently sensitive for this job. The adjustment is done by tuning C3 and changing the turns spacing of Ls, and by inserting an optimum capacitor for C4 (depending on the capacitance of the coaxial jack itself). During the adjustments VSWR checks should be made on both directions, TX - ANT, and ANT - TX. OMs having access to a modern network analyzer will find that a return loss of about 30 dB can be achieved, and that the insertion loss of this VSWR meter will be about 0.2dB. Finally, C2 can be readjusted for minimum reverse indication at 28 or 30 MHz.

Meter dial

For the indication of CSWR there are two choices to employ a meter. The first is to buy a 50uA or 100uA instrument and to draw an additional VSWR dial onto the uA dial. Assuming a linear diode characteristic, the formula $I = M.(\sqrt{S} - \sqrt{1/S})/(\sqrt{S} + \sqrt{1/S})$ may be used to calculate the current value for a specific VSWR. (S= VSWR; M=end value of meter dial).

The other way is to purchase a cheap or used VSWR meter, even if it were designed for CB purposes only, and to replace the whole internal RF circuitry. Then, however, some tests should be made with the instrument of this meter. Most cheap instruments carry a VSWR dial according to the formula mentioned above, but show a noticeable non linearity between current and deflection. From the formula it can be deduced that the meter current for the SET point must be three times the VSWR 2 current and two times the VSWR 3 current. On many cheap instruments, the real SET point will be found at about 80% of full deflection, and therefore a new SET mark should be drawn there.

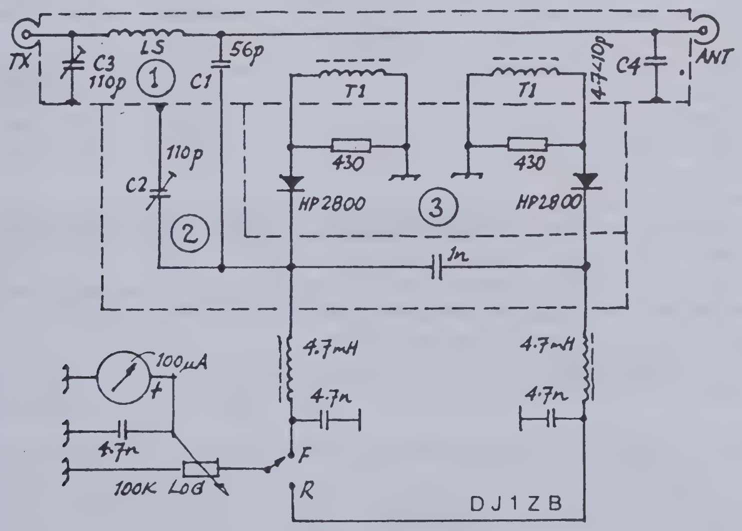
Ferrites

From correspondance I know that, depending on the market situation, members may have difficulties to obtain the Amidon FT50B-43 core. As the inductivity and the turns number of the current transformer is given, one may try to substiture other materials. For RF nickel zinc ferrites like the Amidon 43 or 61 materials are to be preferred. Most high permeability ferrites, however, are magnesium zinc, and tend to get hot in high power applications. This may not be critical in qrp operation. If it should be impossible with other cores to reproduce the inductivity of 450 uH, the parallel load resistor must also be reduced, with consequent losses in sensitivity. The general relation is that the inductive reactance of the current transformer should be at least ten times the load resistor, at the lowest operating frequency.

Ls 5 turns 10mm inner diameter, self supporting, 1mm dia wire, spaced to about 15mm length.

C2 & C3 Philips 110pF foil trimmers. C1 & C4 Ceramic disc capacitors 400v.

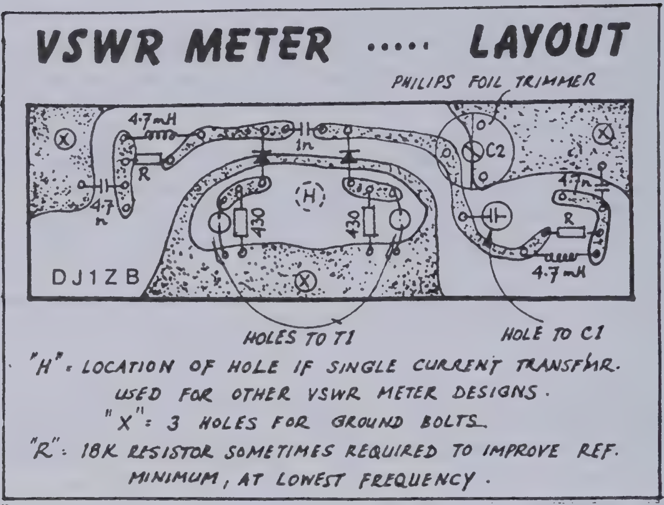
T1 20 turns PTFE insulated 0.5mm dia. 'wire wrap' wire on Amidon FT50B-43 core [FairRite part 5943001901] [1] [2] [3] are the Shielded Sections : See Text



QRPp VSWR METER · · ·

SET POWER·MIN 10MW. MAX.16W

VSWR METER ..... LAYOUT



"H" = LOCATION OF HOLE IF SINGLE CURRENT TRANSFMR. USED FOR OTHER VSWR METER DESIGNS.

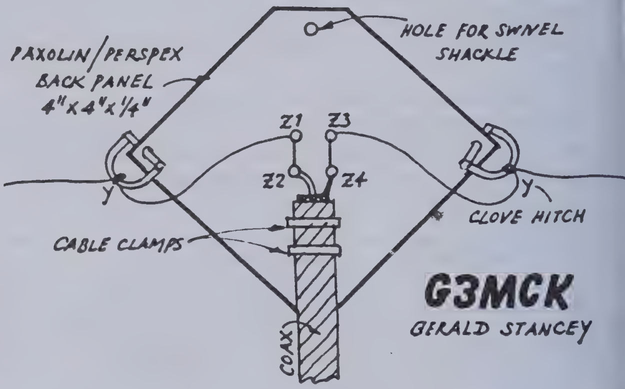
"X" = 3 HOLES FOR GROUND BOLTS.

"R" = 18K RESISTOR SOMETIMES REQUIRED TO IMPROVE REF. MINIMUM, AT LOWEST FREQUENCY.

DIPOLE CENTRE INSULATOR

Gerald Stancy G3MCK

As experimenters, many of us live surrounded by things we have just cobbled together. However, there are a few things that are worthwhile doing correctly the first time. In this class I would put antenna work. A cobbled antenna will always fall down at the most awkward moment, also climbing ladders loses its attraction with the passage of time!



DIPOLE CENTRE INSULATOR

The insulator described was designed for inverted Vee Dipoles where there is no constraint on the weight. In fact, it is not very heavy so could probably be used in the centre of a normal dipole but I have not tried it. It is meant to be a 'fit and forget' item and seems to be just that.

The drawing is self-explanatory but the following points are worth noticing:

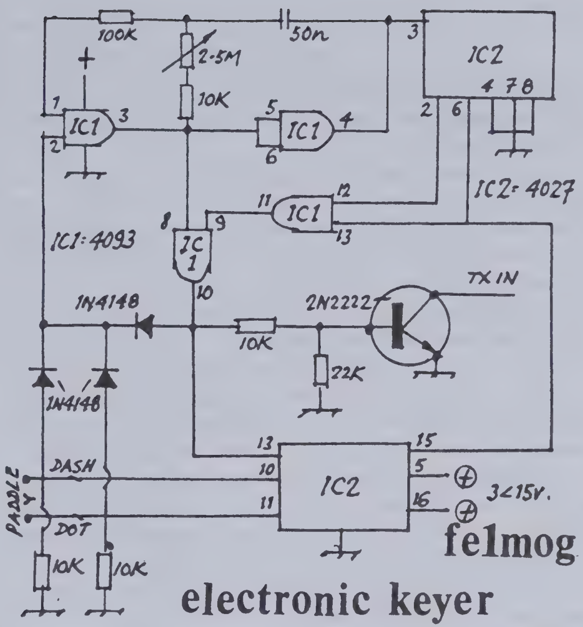
1. Seal the ends of the coax joints with Araldite or non-acidic sealant. ie. one that does not smell of vinegar
2. Marine fittings are expensive but last forever and are easily obtained at a sailing emporia - of which there are several in the immediate area.
3. Stranded insulated wire is more resistant to wind and corrosion effects than a bare single conductor

Secure each leg of the antenna to the D-shackles at points 'Y' with a clove hitch knot, leaving enough wire to connect up to the centre insulator. Feed one leg of the dipole through Z1 then through Z2 (to hold it in position) and join to the inner of the coax. The other leg of the dipole goes through Z3 and is joined to the coax braid which is led through Z4. Then effectively weatherproof the entire joint.

ELECTRONIC KEYER USING 0NLY 14 PARTS

Pierre
Fillinger

FE1MOG



The diagram shows the keyer I use with only 14 components! That was not enough to develop a PCB, I just used veroboard. The unit is very small, and it is possible to glue one IC on top of the other to make it even smaller! Any voltage between 3 and 15v will work. I use a standard 9v battery, the current consumption is very low and I do not have an off switch. The battery and electronics are housed in a small plastic box. The common point of the paddle is hooked to the positive voltage.

If you have a twin paddle, which can be squeezed, the keyer will alternate dot and dashes alone, to save wrist movements and speed up QSOs! The variable resistor is used to adjust the speed. It can be adjusted from very low to very fast speed. If you need to tune the antenna just set the variable resistor at full speed to obtain a tone. On the other hand you may just have a step between dot and dashes if the VR is set on low speed!

WE REGRET TO ANNOUNCE THE DEATHS OF THE FOLLOWING MEMBERS:
Paul Porloo, ON4PQ, 711 (aged 90), Reg Lever, G8QS, 6041, Fred Price, G0FFO, 4551, Ron Wratten, G2JV, 3594, and extend our sympathy to their families and Amateur Radio Friends.

QRP EQUIPMENT WANTED FOR INDIA: The Bangalor Amateur Radio Club, with some 200 members, is interested in obtaining any QRP items as donations. Contact: Nagesh Upadhyaya VU2NUD, PO Box 5624, Bangalore - 560 010. India.

AGCW WINTER QRP CONTEST : 1st COMPLETE WEEKEND IN 1992
For Complete Rules : See SPRAT 65 or December QRP Column in RAD COM or send an SAE to G3RJV
Contest Manager: Dr. Hartmut Weber, DL7ST, Schleiserweg 13, D/W-3320 Salzgitter, Germany.

NOTE: The Tyneside Rally [see last SPRAT] is brought forward to February 29th 1992.

NICKY'S TRF

COLIN DAVIS G3VMU
23 Veron Walk, St. Edmunds, Northampton, NN1 5ST.

I wanted to build a simple shortwave receiver for my son (to stop him playing with my knobs and switches). A circuit was seen in Technical Topics for October 1987 and one was built using this as a basis. It has turned out far better than expected.

TR1 is an aperiodic stage that decouples the detector stages from the aerial. A low impedance input is provided through T1, with a step up ratio of 5:1. As TR1 is a source follower the voltage gain is less than one but there is still some net gain before the detector. The high impedance input is through a 27pF capacitor to the gate of TR1, with this input there is a loss through TR1 but this is no hardship.

The detector consists of TR2 and TR3. TR3 is an infinite impedance detector, with the audio being developed across the 27K source resistor. The tuned circuit is lightly loaded in this form of detector so the Q is high, which means the selectivity is good. TR2 is a Q multiplier which, by adjustment of the base bias with VR1, can be made to oscillate allowing reception of CW and SSB. The connection between the tuned circuit and TR2 is by a 39pf capacitor, which could perhaps be made smaller to reduce even more the damping effect on the tuned circuit. The reaction control is shown as a ten turn pot, these can be bought quite cheaply at rallies and it is worth the expense. The control that this gives over the regeneration is quite a revelation, the "length" of control is a few turns and the circuit can easily be held just short of oscillation for reception of a.m. short wave stations. As the point of oscillation neared the "sharpening" of selectivity is noticeable. Because of the loose coupling and low loading on the tuned circuit the stability is very good and a CW signal can be easily held at the required beat note or a SSB signal resolved for long periods. If a station is tuned in, regeneration set, and then switched off; on switching back on the signal returns into tune even on the 15MHz broadcast band.

TR4 is a simple audio amplifier which is followed by a 5 pole chebeschev low pass filter with a cut-off at 4KHz which is better than 50dB down at 10KHz. This used for broadcast listening, one with a cut-off at 2.4KHz and is 50dB down at 6.5 KHz is used for SSB listening. Any filter can be inserted between the output of TR4 and the volume control. The output of the filter drives an LM386 low power audio amplifier. This is used with either 8 ohms headphones, or high impedance "walkman" types but the gain is noticeably lower with the latter.

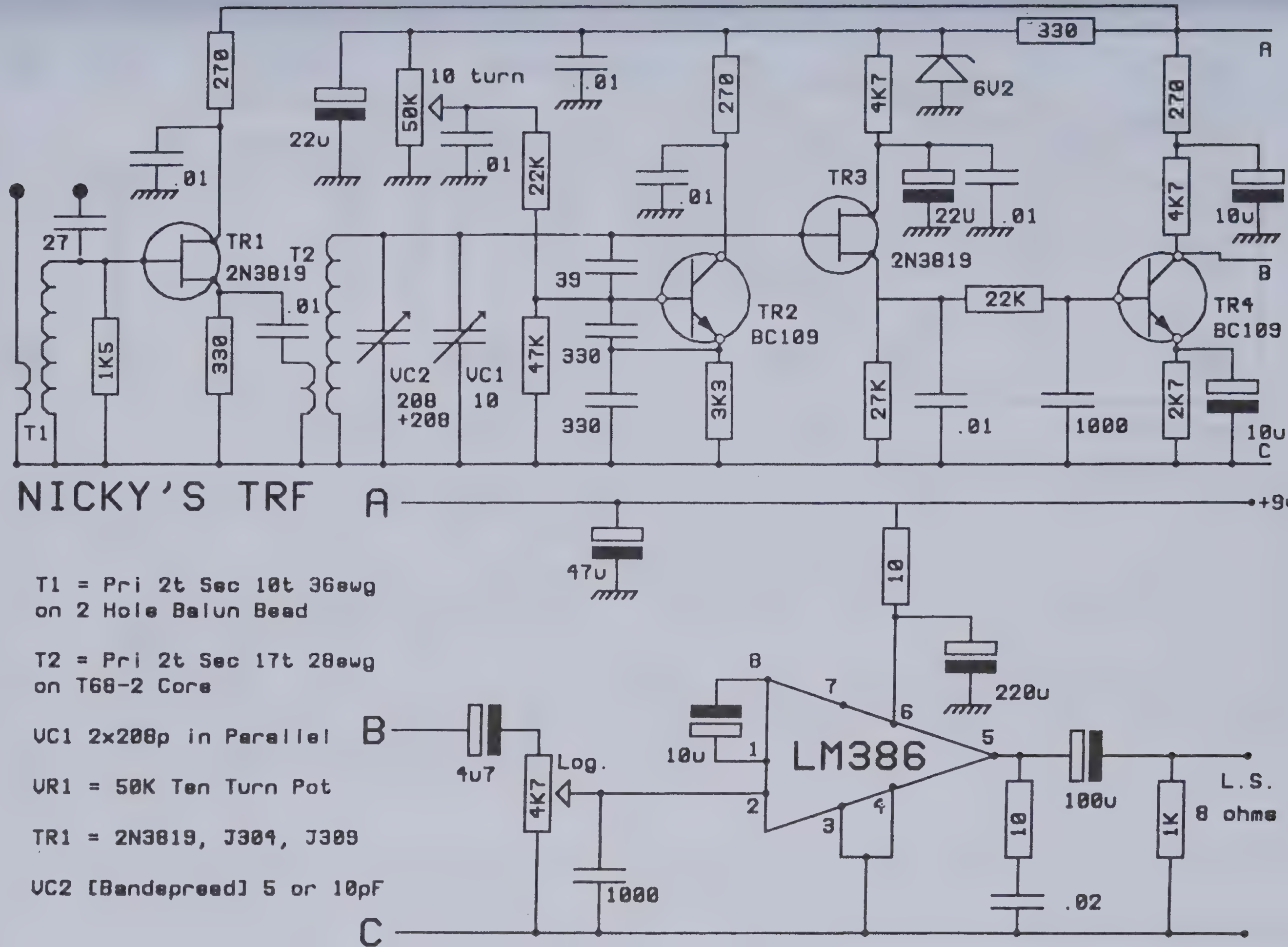
The values given in the circuit diagram tune from 6.9 to 16 MHz, an additional capacitor of 220 pf can be switched in to give a lower range of 5.6 to 7.1 MHz. If other bands are wanted the coil, overwind, C1, C2 and C3 must be changed (Perhaps the values for a Colpitts VFO on the required bands could be used with an overwind on the coil) Better selectivity could be obtained on the higher bands by making use of an airwound coil.

The receiver is built on a homemade chassis(PCB soldered together) and a PCB front Panel, no hand effects can be noticed even without an earth connection, this may be due to the use of a toroidal core.

Now for the important part, the results, these have been quite amazing; with 10ft. of wire draped across the living room., Broadcast stations from all over the world have been heard. Most of Europe on 40 metres and the USA on twenty. G4BMH borrowed it and on the same wire heard VK6. This lead to the receiver being put on a Marconi 2022 signal generator, with 8 ohm earphones a CW signal of 0.1 uV (!!) can be heard, with walkman phones this fell to 0.5 uV, a.m. is 1.5 to 2 uV. These measurements were made into the low impedance input, none were made in the Hi Z input.

One fault is that the detector can be overloaded, no frequency pulling can be noticed though; to get over this a simple attenuator in the aerial lead allows weak stations to be easily tuned in next to strong signals.

Final thought TRY-ONE! 4 controls, no images, clean sounding signals and great fun. Its no longer Nicky's Radio - both of us enjoy listening on it.



NICKY'S TRF

T1 = Pri 2t Sec 10t 36swg
on 2 Hole Balun Bead

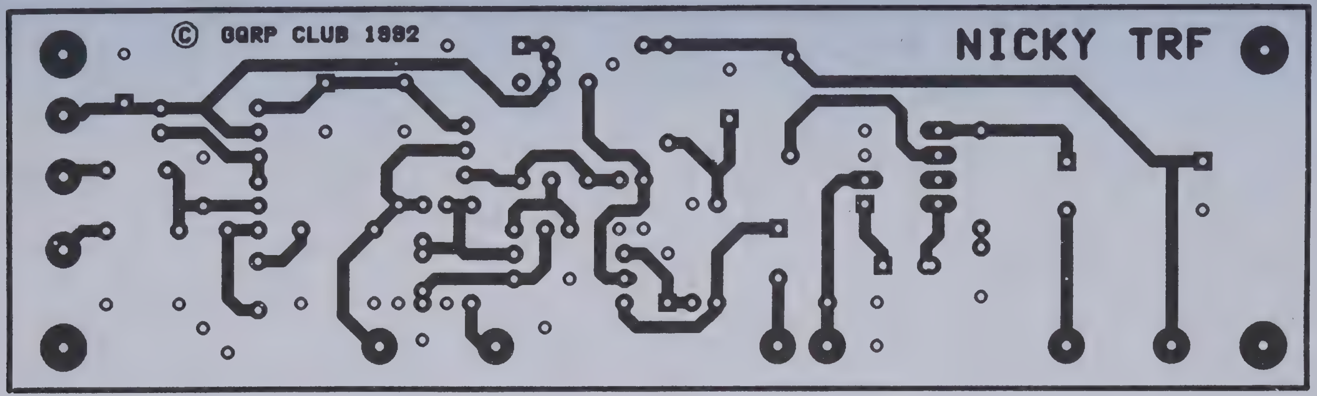
T2 = Pri 2t Sec 17t 28swg
on T68-2 Core

VC1 2x200p in Parallel

VR1 = 50K Ten Turn Pot

TR1 = 2N3819, J304, J309

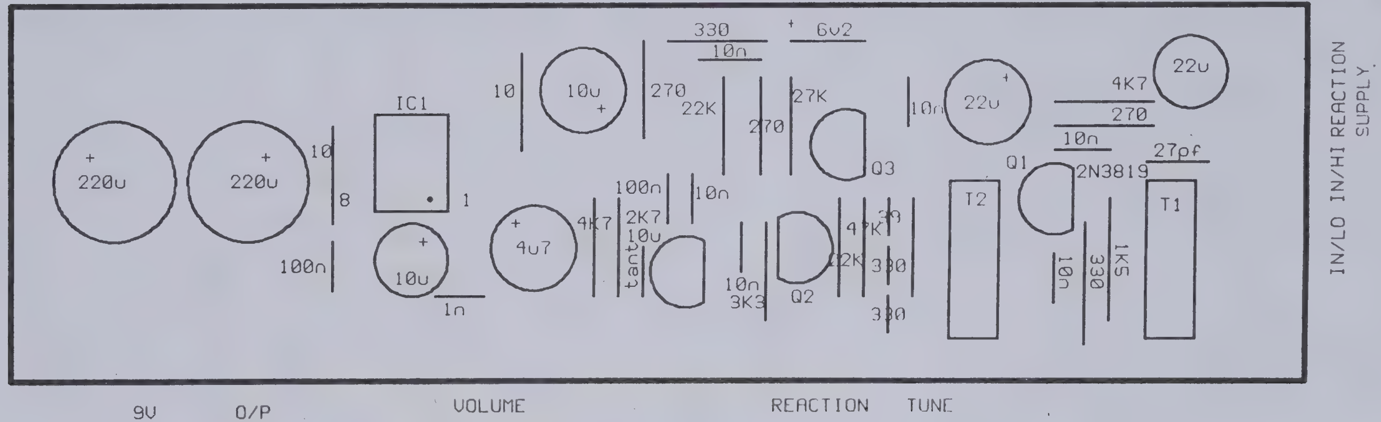
VC2 [Bandspread] 5 or 10pF



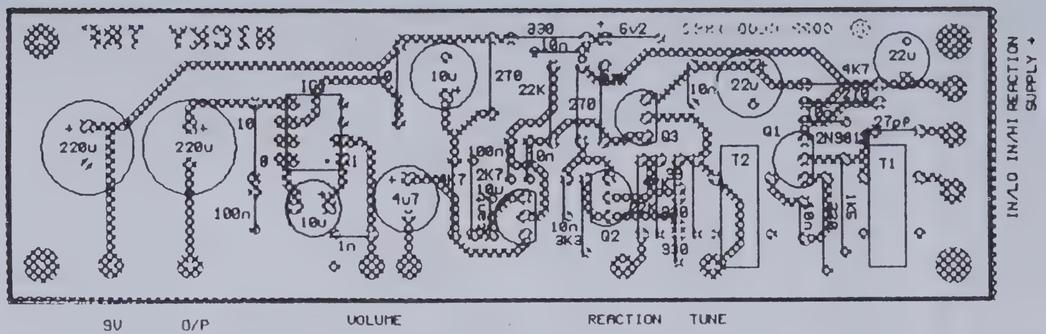
Doubled Sided PCB

Make Grounds and Clearances on Top Foil

NICKY'S TRF FOIL SIDE



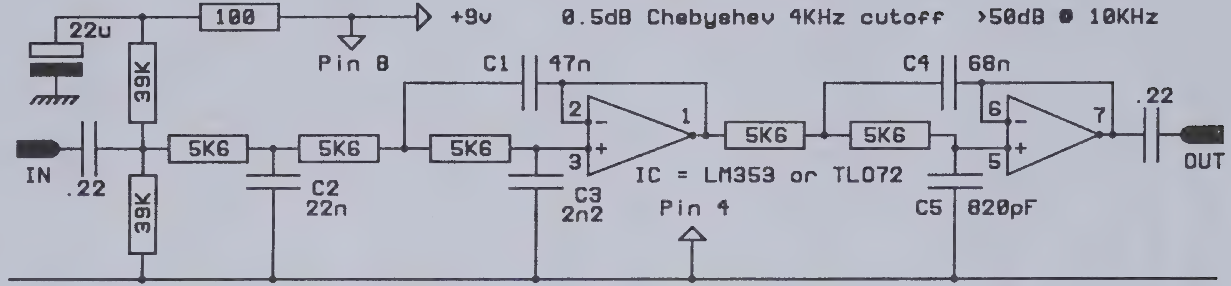
NICKY'S TRF LAYOUT



NICKY'S TRF LAYOUT

FILTERS FOR TRF G3VMU

0.5dB Chebyshev 4KHz cutoff >50dB @ 10KHz



FOR 2.4KHz cutoff > -50dB @ 6KHz Change all 5K6 Resistors to 10K
Capacitor Changes: C1, C2, C3 : No Change C4 = 47n parallel with 15n C5 = 750pF

Several have been built, G3MJW has one with plug-ins (ie L1, C1, C2, C3 and overwind on a Denco base) which covers 1.5 to 30MHz. SSB can be copied quite easily on 10 metres, he also has one with a two-metre converter tuning 10 - 12MHz, NBFM can be copied by careful adjustment of the tuning and reaction controls.

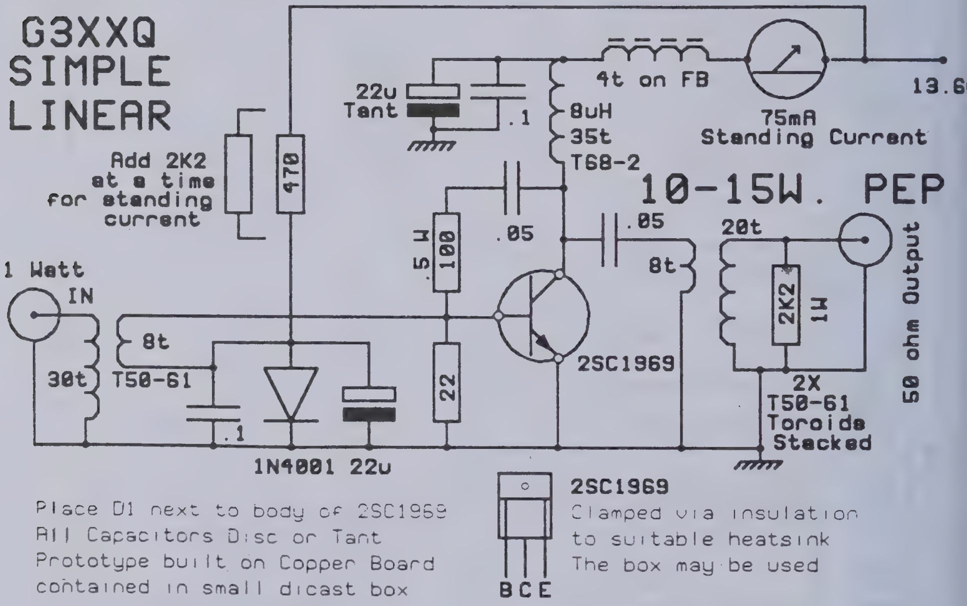
G4BMH has a Chinese copy and a super gainer which has a fixed IF of 2.5MHz and a 2.5 - 4.1MHz VFO so that the receiver covers 0 - 1.6 MHz (long and medium wave in one range - it confused his wife) on this Sweden has been heard in day light hours.

NOTE FROM G3RJV: I have build up a version of this receiver, to test the PCB layout. It works very well. A real radio. I enjoyed every minute of listening around the Broadcast and Amateur Bands on it.

SIMPLE LINEAR PA FOR 160-10m

Len Dixon G3XXQ

A circuit offered by Len in response to the CSP Transceiver PA. The 2SC1969 devices can be supplied by Dixon Electronics, 44 Newton Street, Benshaw, Gateshead, NE8 4XL. [091-478-2965]



Place D1 next to body of 2SC1969
All Capacitors Disc or Tant
Prototype built on Copper Board
contained in small dicast box

2SC1969
Clamped via insulation
to suitable heatsink
The box may be used

IMPROVED DESOLDERING PUMP A Tip From G4FQQ

Not being very satisfied with my desoldering pump I utilised the vacuum cleaner with a modification which is so simple that it is worth using on any occasion. Using a 6 foot length of soft pliable plastic tubing of the type used by winemakers with a bore of about a quarter of an inch, one end is put into the vacuum cleaner tube with a dusting cloth stuffed in beside it to make a rough airtight joint. The nozzle from the desoldering pump is fitted into the other end. You now have a strong constant suction which is light and easy to handle, only requiring occasional clearing of the nuzzle as the plunger is no longer used. Stripping PCBs for components is very much quicker and easier. Revising or rebuilding existing boards is a much cleaner job.

THE POTTENSTEIN RECEIVER **Ha-Jo Brandt DJ1ZB**

This direct conversion receiver covers the cw portions of the 3,5/7/10 MHz bands. It has been demonstrated first on a meeting of a small group of DL and Y2 QRP operators at Pottenstein (English read Pottenstine), north of Nuremberg.

The a.f. section has been taken from the FO-Receiver (SPRAT Spring 1990) which covers the bands 14 to 28 MHz. The mixer stage, however, employs the 74HC4066B, a quad FET switch from the line of fast CMOS circuits, as outlined first in SPRAT Winter 88/89. Here, the simple, unbiased circuit version is used.

The two rectangular oscillator signals with a phase difference of 180 degrees are generated by a 74HCOO. Its r.f. input voltage should be 1.5 to 2 V rms for good symmetrical limiting. Therefore, some form of amplification (not necessarily a dual-gate FET) is necessary between the oscillator and this IC. A counter may be connected to the penultimate section to realize a dial indication. The oscillator section and the first af stage are powered by a 78L05 voltage regulator. It may be replaced by the new low drop regulator LM2936.

The oscillator band switch is a miniature DPDT switch with an open middle position (for 10 MHz). The rf input circuit covers all three bands, but it may be necessary to adjust the number of turns of the coil so that the 3.5 MHz band is tuned just before the capacitor plates are fully meshed.

AF Amplifier notes

The original four stage a.f. amplifier of the FO-receiver has been designed wit.h BC168A transistors. Reproducing this circuit for the Pottenstein RX with BC548C (highest amplification class), including the redesign of the base resistors for half the supply voltage on the collectors, led to an unnecessary high amount of af amplification. However, just omitting one stage gave the impression that the gain could be too low under critical receiving conditions. Therefore, the four stages were maintained and class A transistors employed in the last three stages. This immediately reproduced the same characteristic as with the FO-receiver. The low noise type BC549 is available in class B or C only, but this does not matter. From these experiments it may be conducted that three high gain or four low gain transistors are the practical limit in an af amplifier for dc receivers, driving headphones.

Mixer comparisons

Occasionally some slight am breakthrough has been noted on 10 MHz (never in conjunction with the mini-atu), where the tuning capacitor is almost at minimum. Therefore, comparisons have been made between the FO-receiver, employing a SBL-1 type mixer, and the Pottenstein RX, using a signal generator with 100% am. Surprisingly, on both receiver am breakthrough became noticeable at a carrier level above 10 mV. This seems low compared to the high dBm figures published in normal intercept point measurements. But it also shows that in a d.c. receiver the slightest tendency of nonlinearity is made audible by the high amount of a.f. amplification.

This comparison also shows that the 74HC4066B mixer circuit (even unbiased) is a cheap but equal substitution for bipolar diode mixers, especially for the lower bands. Due to the multi stage oscillator section, pulling of the oscillator frequency by strong nearby signals has never been observed, and the receiver may be used to monitor the own transmitter signal.

Construction

As the FO-RX, the Pottenstein RX consists of a small and a larger metal case screwed together. The larger case contains the r.f. input circuit, the mixer IC, the a.f. amplifier and the 5 V regulator. The oscillator

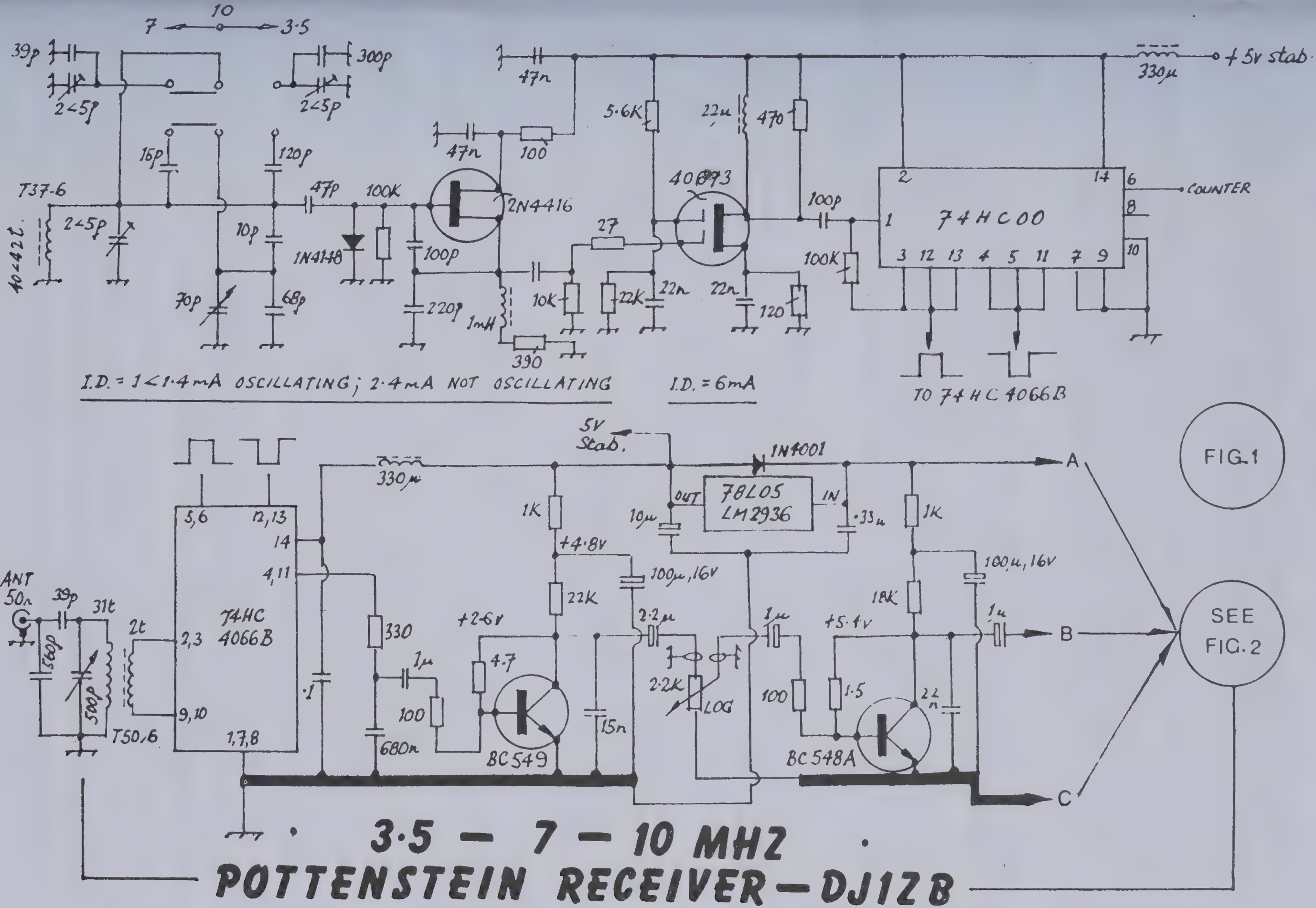


FIG.1

3·5 — 7 — 10 MHZ
POTTENSTEIN RECEIVER—DJ1ZB

section is housed in the upper small case. Three wires run through a common hole between both cases: Two slightly twisted wires for the oscillator signal, and the +5V line. Due to this construction, hummy reception, caused by oscillator radiation, has never been a problem. Just some slight microphony will be noticed when beating the box near the r.f. input tuning capacitor with a pencil or other tool.

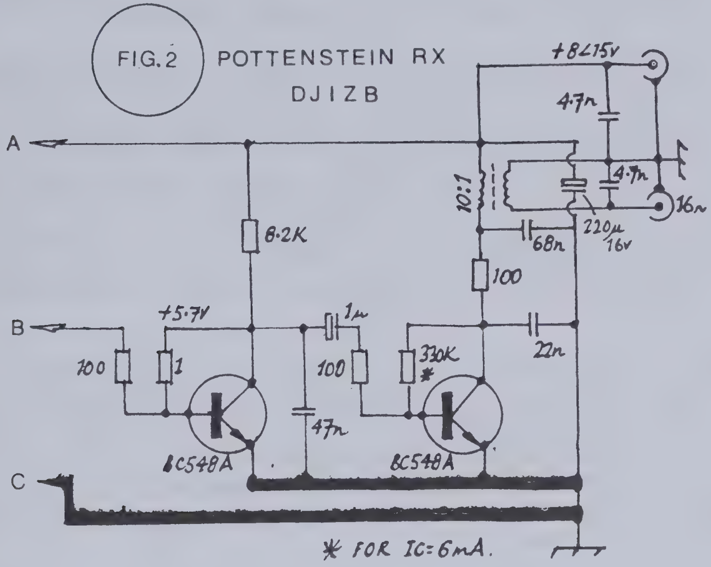
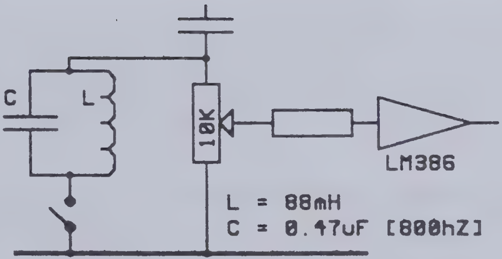


FIG. 2

* FOR IC=6mA.

SIMPLE CW FILTER
Peter Brodribb
G3ONL

A parallel LC circuit added to an audio amplifier can be very useful for removing some of the slush on CW. It is best added across a fairly high impedance part of the circuit eg across 10K [or higher] volume control.



SIMPLE CW FILTER

An 88mH toroid and a 0.47uF would do for 800Hz. Other values of inductance will need suitable values of capacitance for the centre frequency of your choice. Aim for as high a value of L as possible commensurate with a reasonable Q. If you have lots of patience and a suitable ferrite core you could wind your own inductor. 88mH inductors are still available at rallies or suitable alternatives are available commercially.

NOTE FROM G3RJV: Isn't it surprising how circuits do the rounds - I recall describing this idea several years ago. I often it to receivers using the TOKO 10RB 181LY-823 [82mH] available as Cirkit Cat. No. 34-82303, with a 0.47uF capacitor.

A WIDE RANGE 80 METRE VXO **Ha-Jo Brandt DJ1ZB**

A newcomer request for a simple QRP TX initiated me to tackle the problem of a 80 m VXO. On the higher bands I have never found it difficult to obtain a sufficient pulling range; it had also been possible to pull the popular 5.0688 MHz crystal, doubled in frequency, over the most important CW portions of the 10 MHz band, down to 10100 kHz, but for unknown reasons 80 m seemed to behave differently.

I started with my TTL oscillator circuit (SPRAT Nr 51, Summer 1987) with a 3.579 MHz HC-18/u crystal, and inserted a variable 200 pF foil capacitor and a series inductor in the form of molded r.f. chokes. Obviously a rather high inductor was needed to achieve a reasonable pulling range. But single chokes of 220 uH or more did not work, perhaps due to low Q. Finally, with a series of three 100 uH chokes, I got a pulling range from 3579 to 3568 kHz! Next, I built a 300 uH high Q coil, employing a Siemens 80K1 pot core. But this coil did not work. Measuring the self resonance frequency of this pot core coil showed a value of about 2.1 MHz. Therefore, at 3.5 MHz this coil must have acted like a capacitance! So it became clear what the real need for a 80 m VXO coil was: A high inductance with very low parasitic capacitance! Surely you have to sacrifice some space to achieve this, and it became evident why the series connection of small coils only really worked.

Then I added two 22 uH chokes in addition to the three to 100 uH. The pulling range increased from 3579 to 3557 kHz. This seems to be a way to trim the pulling range to personal needs. However, as the effects of very small parasitic capacitances will influence the pulling range, you may not wonder if you may need different choke values. Also, a 3579 kHz crystal in the HC-6/u case, or HC-33/u with wire leads, will need less inductor, about 250 uH. Besides the need for small parasitic capacitances, the Q of the choke is still of some importance, and physically larger coils, in the form like a 0.5 to 2 watts resistor are to be preferred, especially for the higher inductance values.

Finally the oscillator scheme of Fig. 1 was worked out. The rotor side of the variable capacitor was connected to the low impedance TTL output. Also, with this capacitor at its minimum value, some resistive loading of this point (1 nF, 680 ohms) improved the starting of the oscillator when the supply voltage had been applied.

After these TTL experiments the knowledge gained was also applied to a VXO with discrete transistors (Fig 2). The p-n-p transistor, incidentally at hand, had been employed as a buffer stage between VXO and frequency counter. The same pulling range as with the TTL oscillator could be achieved. After the capacitance C2 had been reduced to 390 pF, the supply voltage could be reduced to 5 volts, maintaining the full pulling range.

Regarding the availability of the 3579 kHz crystal, these VXO circuits will also be of much interest for the new Novice Class in the UK.

Higher bands TTL VXOs

Again referring to my former article on TTL transmitters (SPRAT Nr 51, Summer 1987) I like to withdraw my former statement that it was impossible to build TTL VXOs with large pulling ranges. If one finds that when tuning the VXO the frequency suddenly jumps to an entirely different frequency, the trick is to load the VXO coil by a parallel resistor that limits the Q to about 3 to 5, on the wanted operating frequency. In other words, the resistor value must be 3 to 5 times the reactance of the coil (Fig.3). However, when comparing TTL circuits to discrete transistors, the buffer action of a linear element will always be superior to that of a saturated stage.

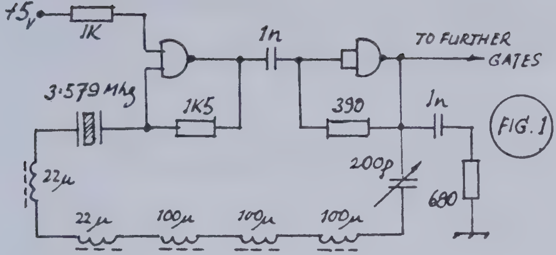


FIG. 1

80m. VXO WITH TTL GATES ——————DJ1ZB

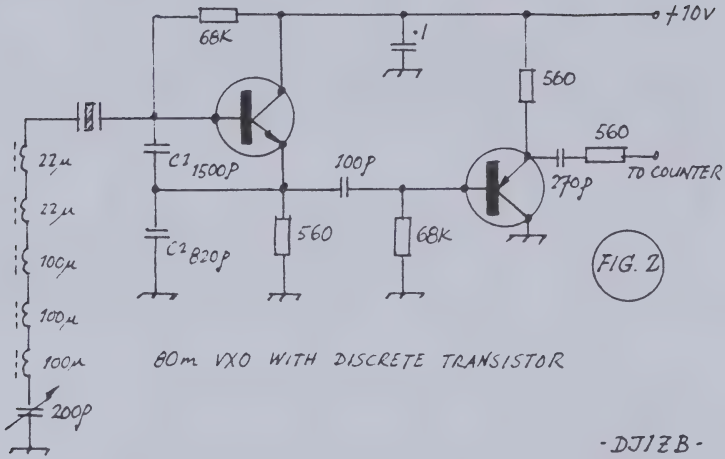


FIG. 2

80m VXO WITH DISCRETE TRANSISTOR

-DJ1ZB-

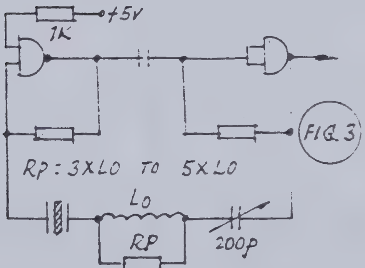


FIG. 3

HIGHER BANDS TTL VXO

THE 'NAT' (Not Another TX) TRANSMITTER George Burt GM3OXX

1/5 Essendean Terrace, Clermiston, Edinburgh

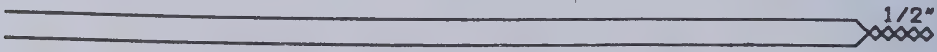
Aye, I know! Not another simple TX from OXX. It came about by think of a simple rugged wee TX for the club novices.

The idea was to revamp an old style valve TX, by using two V mosfets in push pull, so it could run a few watts out without it dying the first time the key was held down long enough to tune the ATU.
A few VN66AFDs were bought as that was all our local shop had.
A PCB was made and circuit built, but nothing worked "OH", had been using what I thought was the correct base connections for the VN66AF from the Siliconix handbook, but the VN66AFDs are different. So, after the leads were crossed over it all worked.
There is not a lot more to say about the circuit except it works well, is rugged and 50% efficient.
Of course, it can be made to run on other bands and if you remove the fixed cap across the drains, will run on 40 but not "correct."
As the idea was for a novice TX, three boards were made and all worked fine.
A test was done using only the TX output tuning as I don't have a low pass filter or swr meter capable of handling the power out. I could only test it to 15V as my power limits at one amp
With a 50 load and an HP power meter. The voltage was done in 1V steps with the standing current adjusted for each step at 100 mA

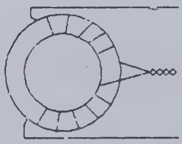
10v	830mA	4.2w out
11v	900mA	5.2w out
12v	1 amp	6.1w out
13v	1.05 amp	7w out
14v	1.1 amp	7.8w out
15v	1.15 amp	8.6w out

THE VN66AFD [Not Same pin-out as VN66AF]
IS AVAILABLE FROM RAPID ELECTRONICS
TEL: 0206-751166 [Price 0.95p in one offs]

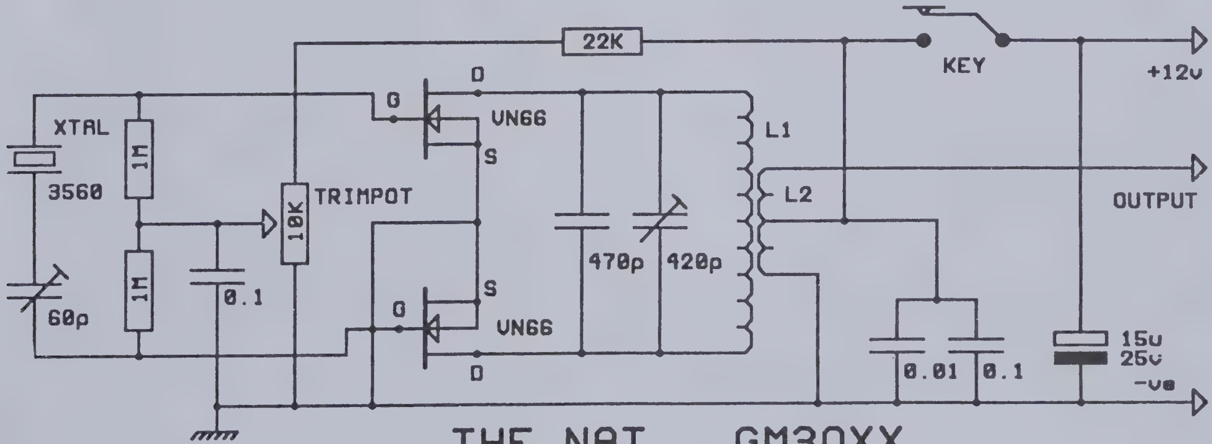
Will be a bit less through a low pass filter but more than enough
CONSTRUCTION NOTES
No attempt was made to make it small so the PCB has lots of room.
The only difficult part will be winding L1&2. I used .71mm (20swg) and .40mm PTFE covered (20swg O.D). When winding L1 cut 18 inch of .71mm fold in two, twist for half an inch, scrape clean and solder the twist.



Then start by winding ten turns to the left, and ten to the right. Try not to wind to tight, as it will make it easier for the link winding. Now cut 18 inch of .40mm PTFE, start at one end and wind 19 turns between the 20 turns of L1.
(Remember as soon as you pass the wire through the toroid its one turn).


WINDING L1

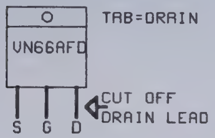
If you can't find any .40mm PTFE any thin gauge PVC will do but L1 may need to be reduced to .5mm, if the link wire is bigger than 20 SWG O .D. because its a tight squeeze.
When setting up, with no xtal fitted, key down adjust rim pot for a 100MA standing current, fit xtal and tune for max. smoke.
No extras have been fitted, but pass keying low pass filter and aerial change over have been left to you.



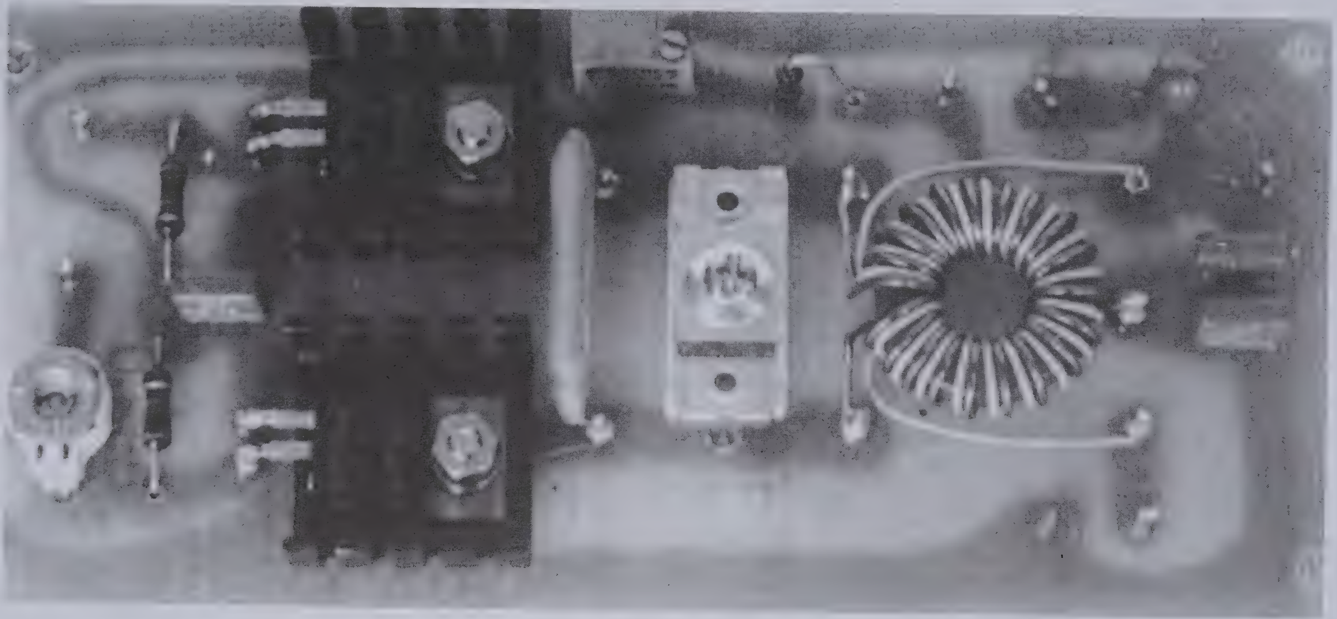
THE NAT GM3OXX

L1 20t .71mm [20swg] L2 19t .40mm PTFE [20swg od] WOUND ON T68-2 SEE TEXT

NAT LAYOUT



420pF TRIMMER
TANDY CAT. No.
272-1336



THE K4TWJ QRP PEN

Dave Ingram K4TWJ
4941 Scenic View Drive, Birmingham, Alabama 35210. U.S.A.

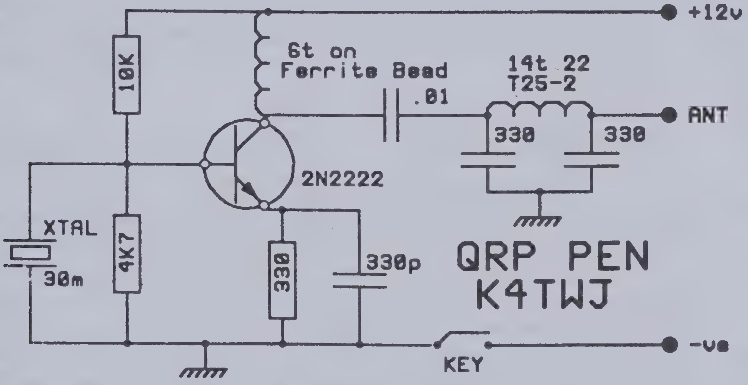
Some time back I decided to really go QRP in style. Rather than building another QRP rig in a conventional box where I must add an external power supply, key etc. I put everything into a small package. the result was my 350mW transmitter built into a larger size ball pen case. This little gem is shown in the picture. The push button at the top is the key. Inside there is a 12 v battery and full transmitter circuit. The antenna connections are at the bottom of the pen.

I can walk up to a transceiver at a rally, tune to 10.105MHz, and start sending to the rig. At home I have used this transmitter to contact several stations in five countries.

The circuit uses one 2N2222 [or 2N3904 or ZTX651] transistor in a basic oscillator arrangement. The schematic is shown. Power is supplied by a small cigarette lighter battery obtained from Radio Shack. This battery is slightly smaller than a regular 'N' 1.5v. cell. By removing the outer wrapper, it will slip into the cap of the pen. Wires from the top 'key' also slip by the battery. the circuit is built 'open air style' and slipped into the pen base. The crystal is very small and slides into the base right where the cap fits on the pen.

It continues to be a source of amazement and creates excitement every time I show it. Now the QRP Pen has worked several countries - my next project is putting the receiver in with it!

Dave is a regular columnist for CQ magazine and author of several books including "Keys, Keys, Keys"



N.B.T.V.A.

The Narrow Bandwidth TV Association (founded 1975) deals with the mechanical and low definition modes of ATV. All TV cameras and receivers are "home brew" and construction is inexpensive. Some basic skills with a saw, hand-drill, and soldering iron are an advantage.

NBTV produces moving pictures and should not be confused with Slow Scan. A bandwidth of 6-7 KHz.is needed and recording of signals on an audio cassette recorder is possible.

The annual subscription is £4.00 (or £3.00 plus the plastic wrapper in which a recent "Sprat" arrived). This covers a 12 page quarterly newsletter and an annual exhibition in April/May in the East Midlands.

Apply to the Membership Sec., D A Gentle G4RVL, 1 Sunny Hill, Milford DE5 0QR, enclosing a crossed cheque or PO. payable to "NBTVA".

FURTHER NOTES ON THE QRPp VSWR METER [SPRAT 69]

Ha-Jo Brandt, DJ1ZB, Lohensteinstrasse 7/b, D - 8000 Munich 60

The construction of a second version of this device revealed a problem which led to a slight modification of the original circuit. When trying to align the meter it was impossible to get a better reflected minimum that S=1,2. Comparing the differences in the construction of the first and the second version, the problem has obviously been aggravated by the smaller cross section of the screened area 1. In the first version, this section was 30 by 30 millimetres, but in the second just 16 by 20 millimetres. This led to an additional capacitive load for the 430 ohms resistors across the current transformers, causing some phase shift of the r.f. voltage generated. Luckily however, the whole construction could be saved by introducing another phase shift in the capacitive divider, by inserting a small resistor in series to the 56 pF capacitor. When a potentiometer of 47 of 100 ohms is used at first for this purpose, an exact null can be achieved even at 30 MHz by alternate alighting of this resistor and capacitor C2. Then this resistor is measured and replaced by a suitable fixed value, and the alignment repeated by adjusting C2 alone.

For the second version, the optimum value had been 39 ohms. After this solution had been found, the first version was investigated again to see if any improvement could be reached. Here the best obtainable minimum had been S = 1,05 at 30 MHz. By inserting a potentiometer it was also possible to get an exact minimum, and the optimum resistor value was found to be 22 ohms.

For safety reasons, the dissipation rating of this resistor should be in the 0.5 to 1 watts range. The maximum dissipation will be needed when the maximum power of about 16 watts at 30 MHz is applied to the meter. Therefore, the general aim must be to need a resistor as small as possible for correct alignment, and this can be achieved by a construction maintaining a parasitic capacitance across the current transformers as small as possible. For a general relief of this problem, the load resistor of the current transformers could be reduced to 390 ohms or even less, but this would also lower the maximum sensitivity of this meter (about 5 mW for full deflection to the SET point).

IC735 MODIFICATION Dr. Gordon Bennett G3DNF

Further Reduction of DC/DC Converter Noise

The modifications described in SPRAT 68 dealt with the problems caused by harmonics generated by the on-board DC/DC Converter [IC19], which runs at about 7kHz. Harmonics falling within the IF passband were avoided by detuning the DC/DC converter by up to 1% for optimum results. Further experience has shown that various external influences, such as change in temperature and supply voltage can upset this adjustment.

A radical but simple, new modification eliminates all the problems previously encountered. This is to replace C315 [.001uF] by .01uF, thereby reducing the oscillator frequency of the DC/DC converter from 7kHz to 700Hz. Rf harmonics generated by IC19 then become insignificant and there are no more 'birdies' in the front end or heterodynes in the IF passband [PBT] range.

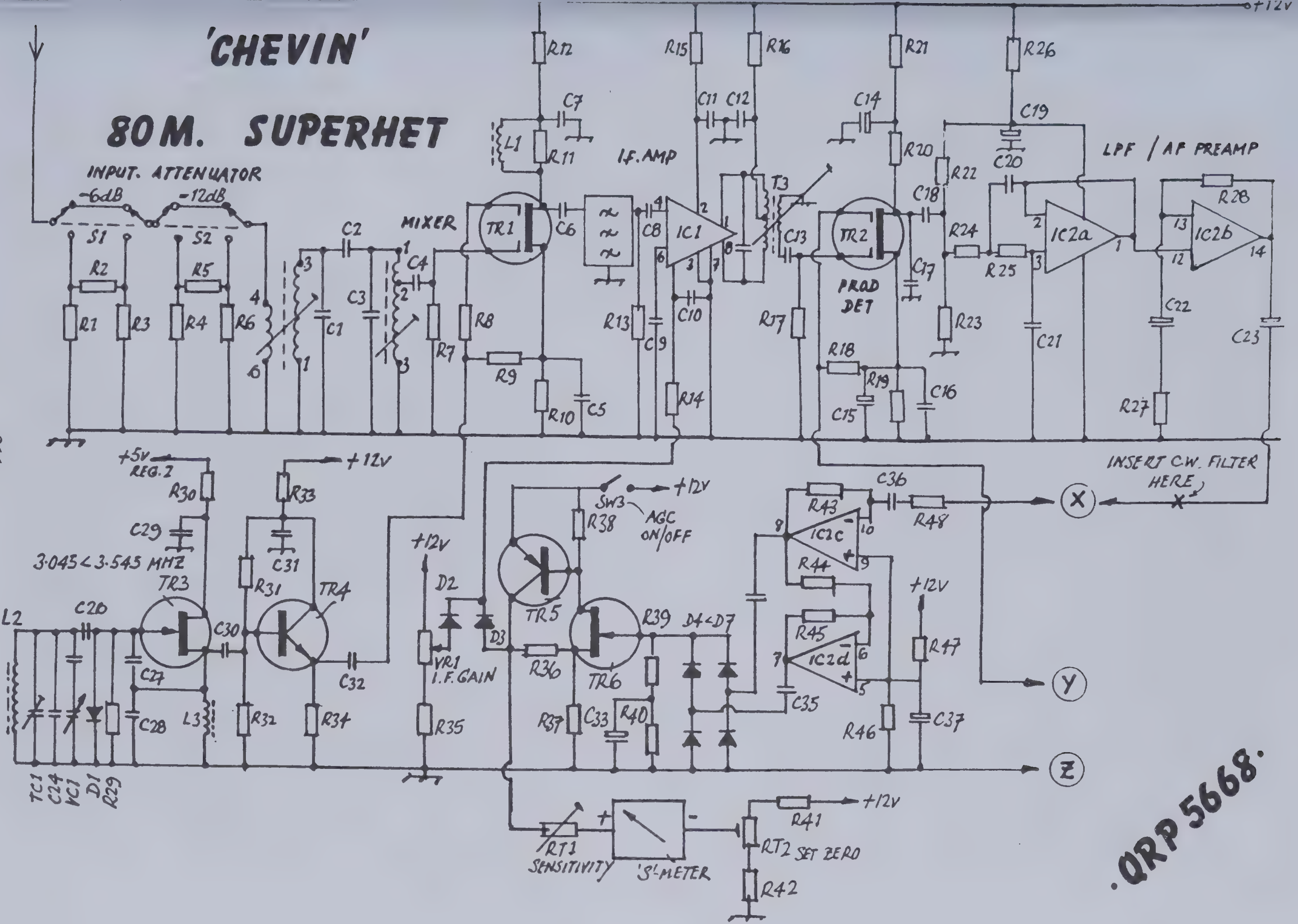
Despite fears of possible AF pick-up, there is no discernible 700Hz tone from the AF amplifier section. The general effect of the modification is to make received signals sound clearer and cleaner, while operation of the 'PBT' control is much sweeter.

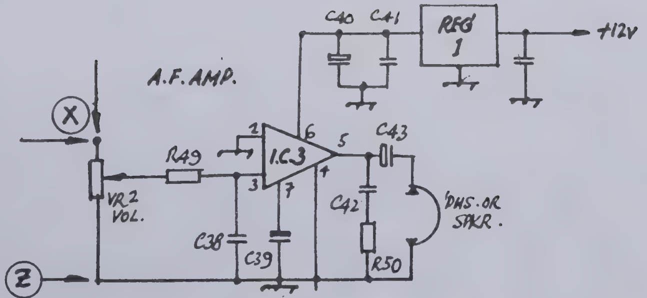
The modification may be made instead of, or in addition to, those previously described. Refer to SPRAT 68 for the method of getting to C315.

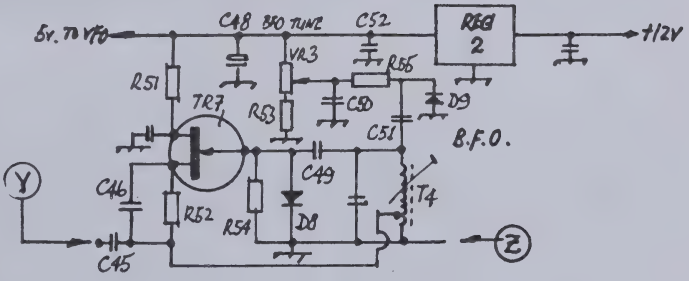
SOME RUSSIAN CW QSO 'SLANG' from Igor Grigorow of the U QRP Club:
MY QSL OK = MY QSL BUDET, TNX = BLG, SPB, HELLO = ZDR, GOODBYE = DSW,
HAPPY NEW YEAR = S NOWYM GODOM, HAPPY CHRISTMAS = S ROZHDESTWOM.

'CHEVIN'

80M. SUPERHET







COMPONENTS LIST

T1,2 TOKO KANK3333R
T3 TOKO YHES17105R2
T4 TOKO YHCS11100AC
L1 1mH RFC
L2 30 turns 30 swg
on T50-6
L3 470uH RFC

F1 455KHz SSB Filter
MURATA CFM455J1
[See Notes]
M1 200uA [ex-tape etc.]
SW1,2 DPDT Min
SW3 SPST Min

TR1,3 40673,3N201 etc
TR3,6,7, BF244, 2N3819 etc
TR4 BC182, BC108 etc
TR5 BC212, BCY71 etc
D1-8 1N4148, 1N914 etc
D9 1N4001
IC1 MC1350
IC2 TLO74
IC3 LM386
REG1 78LO8
REG2 78LO5

R1.3 150
R2 39
R4,6 82
R5 91 [2X180]
R7,22,23 47K
R8,30,51 56
R9,14,18,46
47,48,49 22K
R10,19,52 220
R11,13 2K2
R12,15,16,21
26,33 100
R17,32,38,44
45,53 10K
R20,27,37,29 1K
R24,25 12K
R28 3K3
R29,54,55 100K
R31 56K
R34 470K
R35 5K6
R36 SEE NOTES
R40 1M
R41,42 1K5
R43 120K
R50 10
RT1 100K preset
RT2 4K7 preset
VR1 10K lin
VR2 10K log
VR3 47K lin

C1,3 33p cer
C2 4p7 cer
C4,13 470p cer
C5,10,16,17
46,50 10n cer
C6,8,38 4n7 cer
C7,9,11,12,29,31
41,44,52,53 100n cer
C14,40 47u elec
C15,39 2u2 elec
C18,34,35,36
42 100n mylar
C19,43 100u elec
C20 10n mylar
C21 3n3 mylar
C22,23,37 1u elec
C24 See Notes
C25 See Notes
C26 470p Poly
C27,28 1n Poly
C30 47p cer
C32,45 1n cer
C33 4u7 tant
C48 10u elec
C49 22p Poly
C51 3n3 Poly
TC1 60p Foil Trim
VC1 See Notes

THE CHEVIN 80m SUPERHET RECEIVER

David Limmer 29 Orchard Street, Otley, Leeds, LS21 1JU

The Chevin is a local beauty spot, before anyone asks - was born out of a desire to make a receiver of rather better specifications that the normal DC units (as much as I revere them) which would be relatively simple, use standard components and yet offer both good performance and a few "features" such as AGC, 'S' meter, etc.

I was particularly interested in G8PG's review of the Malsor kit Rx, as the designs, by coincidence, seem to run parallel in several respects. however, I claim no originality for the "Chevin", acknowledging as ever "Solid State Design for the Radio Amateur" for both inspiration and chunks of the circuitry. All building blacks, however have been thoroughly tested and optimised for good performance.

The circuit should in fact be self-explanatory, and I have enclosed separate construction/operating notes. Other refinements can easily be added, such as a CW filter (at the point indicated on the main diagram, in the AGC loop) and muting for the licensed fraternity. Again, "Solid State Design" will give the how and why.

Generally, performance is very pleasing. Stability is good, selectivity more than adequate, sensitivity excellent, and I have noticed no over load problems. Best DX so far on 80m has been 5N0 using a 40ft long wire via an L-match.

Other refinements? - well, the "Chevin II" is already under way, using a much cheaper HF Xtal filter (a la Malsor) and a better, balanced, MOSFET mixer. I am also investigating simple, matching HF converters, and if an interest is generated by the basic design, I'll be glad to write these up for a future article or two.

Constructional/Operating notes

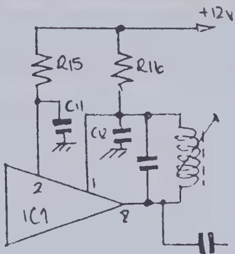
The design is for 80m (3.5 to 4.0 MHz to allow use of HF converters), although constructors should be able to modify for 160m without difficulty. 40m may also be possible, but should be regarded as the upper limit due to the low IF.

Filter

The specified filter (Murata (FM45S J1) is the most expensive single component, but has a respectable performance for such a compact unit. (2.68kHz @ 6/50db) Other 455KHz units could be tried with mods to the PCB. An alternative tried was the cheap CFU455 1T (KHz) which was surprisingly good.

IFTS

T3 was chosen as it offers a centre-tapped primary for IC1 and a high-z sec. for TR2. However, a scrap IFT from a "Tranny" can be used as follows:-



T4 was also called from a scrap "tranny" and was a final (black) type.

Semiconductors

Uncritical - any of the common MOSFETS and FETS can be used for TR1, 2, 3, 6 and 7, and similarly, any of the common bipolars for TR4 and 5. Diode types are equally uncritical. IC2 was chosen for low noise, but LM324 will work well. IC3 was an LM386N1 as this was to hand, and was run from 8v as this particular type of 386 isn't happy with 12v. If the LM386N4 is available, Reg. I can be omitted.

AGC circuitry

This a little more complex than is usual in RXs of this type, using a phase splitter and full wave diode bridge, but is worth the effort. Very strong signals will cause overshoot, in which case VR1 should be backed off and for attenuation switched in. Delay time can be modified by changing C33/R40. Use a tantalum cap. for C33. R36 should be chosen to give 5v at TR5 collector. (between 820R and 2k2 approx.)

VFO
Runs on low side of signal, as a far spurii were noted when running on high side (3.955 to 4.455MHz) the choice is yours! In the prototype, C24 was 180pf and C25 470pf with a 350pf air-spaced variable in series to cover the full 500khz Use good quality polystyrenes or prepare to drift! Mount L2 vertically with araldite.

PCB [*A Photocopy of the author's PCB layout is available from G3RJV send SAE marked 'Chevin'*]
Many constructors prefer to build in modular fashion, but the Rx can easily be made to fit a single 120 x 95mm PCB without crowding. A suggested layout is available from G3RJV. Double-sided board was used in the prototype because I happened to have a piece of the right size, but single-sided should be fine.

Alignment
The VFO was set using a general coverage receiver. With the AGC off, T4 was adjusted to zero beat with VR3 approx at mid-travel. T3 is simply peaked for maximum noise (keep the AGC off) and T1/T2 peaked at mid-band. The two S meter pots are slightly interdependant, but easy enough to set in practice. I used a simple 1 - 10 linear scale simply to show comparative signal strength. (I doubt if it's worth the effort of calibrating in pukka S units!)

A SIMPLE RF DETECTOR

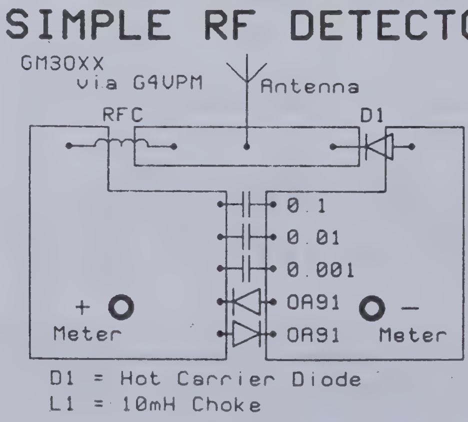
Andy Stafford G4VPM - from an idea by George Burt GM3OXX

From TARS TALK : Magazine of the Torbay Amateur Radio Society

It seems that every time I visit the shack of George GM3OXX I come back with details of, or the idea for, an interesting project. When I was up there at the end of January, I came away with both the details of, and an example of, a nice little RF detector.

The beauty of this project is that it is totally self-contained, doesn't need any power and is quire compact (depending on the meter used!) Thus you can take it anywhere including out on field days and such the like and it's quite a useful bit of test gear. I often use an RF probe for aligning oscillators and checking out QRP transmitters. Usually, if there's RF there, its working!

The circuit and construction is very simple. First, find yourself a meter. The lower the current rating of the meter, the more sensitive it will be (50 microamps FSD is nice, 100 is still good). The PCB is fitted to the terminals on the back of the meter so plan to make it a convenient size and shape to fit there. If the meter has got 'bolt type' terminals rather than solder type, the board can be fitted very easily and securely. In the diagram that type of terminal is used.



A SOLAR POWERED 40m TRANSCEIVER

H.C.S. (SPENNY) Spencer G6NA

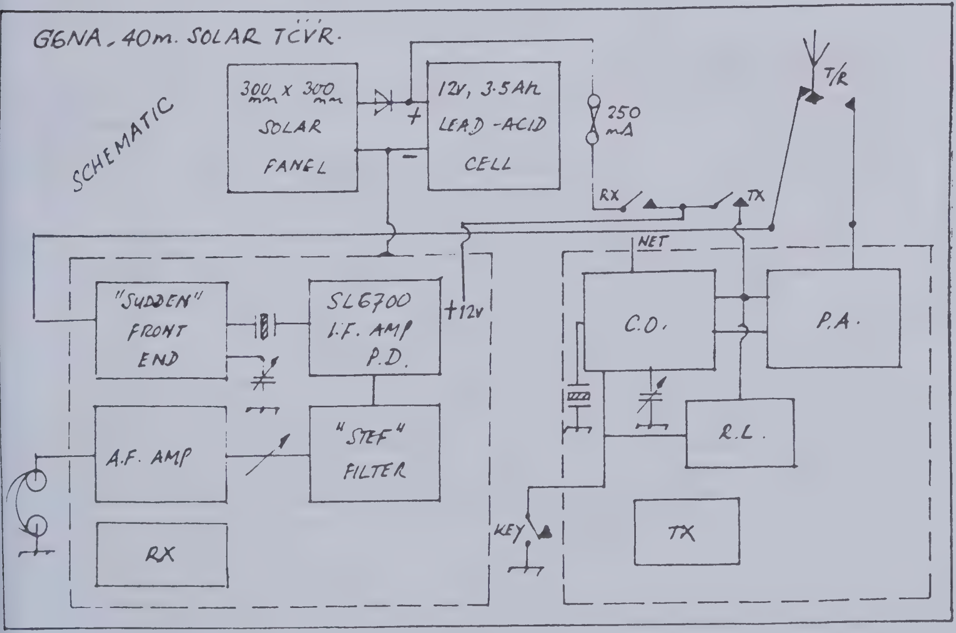
Tilshead, Tom's Field, Langton Maltravers, SWANAGE. BH19 3HN

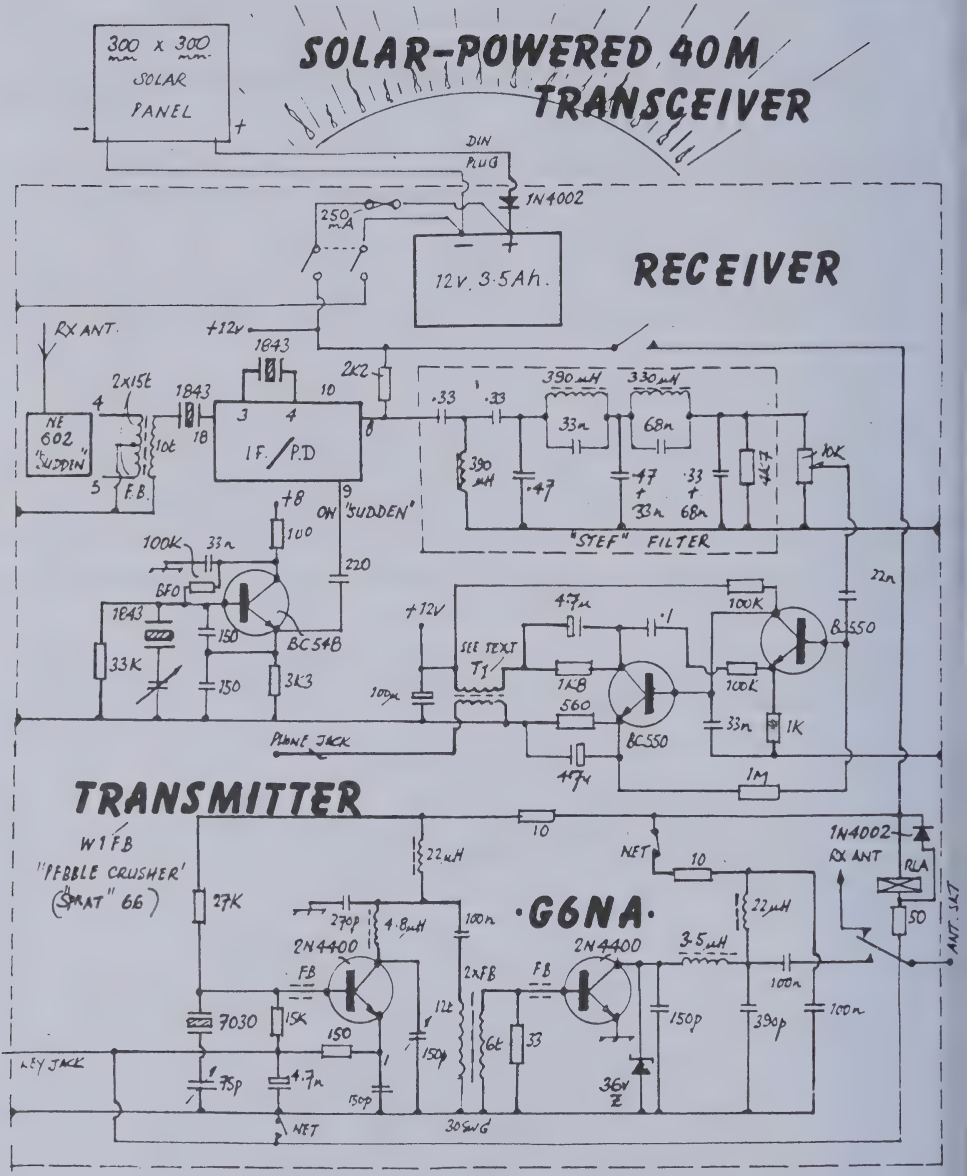
I have had many enquiries about my solar powered 40m rig - here it is.
Early 'monolithic' photo cells were expensive but more recently an 'amorphic' form has appeared made by evaporating the active elements on to glass. See the GW4IED advert in SPRAT for supplies.

I use a panel 300mm square which keeps me well supplied for operating even in winter. The receiver takes 10mA [0.1AH for a 10 hour day]. The transmitter takes 100mA [about 0.2AH per day for my type of operating]. Thus I only need one hour of bright sunshine for daily use with battery storage for dull days. A 3.5 AH sealed lead-acid battery should see me though until Spring when I receive more current than is being used daily.

The Transmitter is a W1FB 'PEBBLE CRUSHER' [SPRAT 66] with a netting button added. The superhet receiver consists of a SUDDEN front end, output being taken , from pins 4 and 5, to an SL6700 via a transformer of 15 bifilar turn primary, 10 turns secondary, wound on a ferrite bead, and a 1.843 MHz crystal. These are cheap computer crystals, three being needed. One connected between pins 3 and 4 of the SL6700 and another for the BFO. The audio output is fed to a 'Stef Filter' [SPRAT 63] made with a 550 Hz cut-off. SL6700 details in RadCom June 1991 pp 44/5. A two stage AF Amplifier drives the Headphones. The output transformer was salvaged from a radio set - it seems to be Prim L=8H, Ratio 7:1. Any small transformer of similar characteristics would be OK. The series resistor must be decoupled to get the right amount of DC feedback.

The whole station, apart from the solar panel and the key [also home-brew] is contained in a box 170mm x 90mm x 250mm deep. Tuning is via a 'Velvet Vernier' drive from a TU9. QSOs have been made with 11 countries, with half a watt, to date, most of them with fellow members.




SOLAR-POWERED 40M TRANSCEIVER
300 mm x 300 mm
SOLAR PANEL
-
+
DIN PLUG
1N4002
250 mA
12v. 3·5Ah.
RECEIVER
RX ANT.
+12v
1843
2K2
2x15t
1843
10
4
3
4
NE 602 "SUDDEN"
10t
18
8
IF./P.D
5
F.B.
9
ON 'SUDDEN'
+8
·33
·33
390 µH
330 µH
33n
68n
390 µH
·47
·47 + 33n
·33 + 68n
4K7
10K
"STEF" FILTER
100K
33n
100
BFO
220
1843
150
BC548
33K
150
3K3
+12V
4·7µ
·1
100K
SEE TEXT T1
1K8
B C550
22n
100µ
560
100K
BC550
33n
1K
PHONE JACK
4·7µ
1M
TRANSMITTER
W1FB "PEBBLE CRUSHER" ("SPRAT" 66)
10
22µH
NET
1N4002
RX ANT
10
RLA
27K
270p
4·8µH
100n
·G6NA·
22µH
50
2N4400
2N4400
3·5µH
ANT. SKT
FB
2xFB
FB
12t
7030
15K
150
6t
33
150p
100n
390p
100n
150
150p
36v Z
KEY JACK
75p
4·7n
150p
NET
30SWG

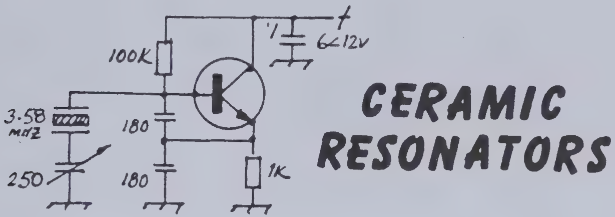
CERAMIC RESONATORS IN RECEIVERS

Ian Macpherson GM3RXU
12 Hawick Avenue, Paisley, PA2 9LD

Ceramic resistors have become available as low cost very compact and robust alternatives to crystals. The Q of these components is lower than that of the equivalent crystals and consequently the frequency of oscillation can be pulled much further than for a crystal.

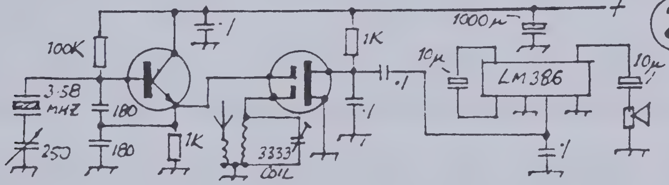
A typical oscillator circuit might be

①



The turning capacitor can be a small medium wave radio tuning capacitor and will cover the range 3.59MHz to 3.515 MHz. This circuit will fit well into a minimum direct conversion receiver for 80 m.

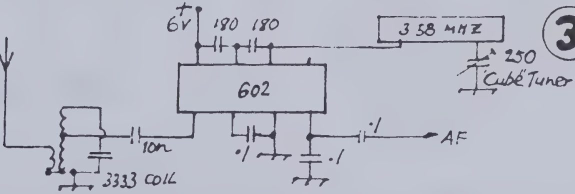
②



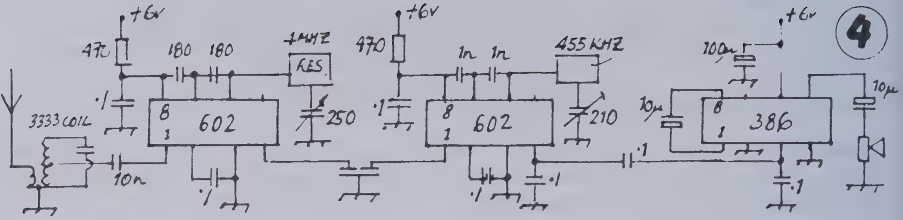
This receiver works well but can be improved by including a simple passive AF filter in the AF feed to the LM386.

The mixer can equally well be an NE602.

③

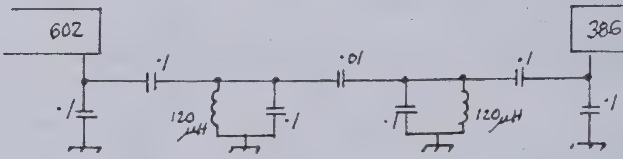


There are a variety of other frequencies available as ceramic resonators and a look at these will throw up several combinations with ceramic filters which are likely to be of use at amateur radio frequencies. As an example, resonators at 4.19MHz, 4.0MHz and 455KHz can be combined with a 455KHz ceramic filter to produce a very simple super gainer with virtually no tune-up requirements.



④

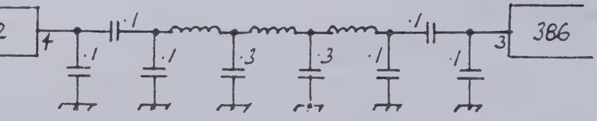
This receiver tunes 3.57MHz and only requires the RF coil to be peaked, everything else is pretuned. The filter can be a type CFU455IT at about £2.00, or a type CFW455HT about £2.50. The 455KHz resonator as the BFO can be tuned with a 250pf trimmer but two small polystyrene capacitors in parallel (137pf and 80pf) are just right to place the BFO on the correct side of the IF passband. As it stands the circuit gives single side band CW reception but with a wide audio band width. CW reception can be improved considerably by the inclusion of a passive AF filter.
The circuit:



⑤

will give a nice peaked response with the 120mH pot cores from Cirkit.

Replacing the 4.0MHz resonator with a 4.19 MHz resonator will tune a portion of the SSB part of 80m. Here a different AF filter will be required and the one shown below will give a narrow passband more suited to QRM elimination than high quality.



⑥

GM3RXU

This is based on the same 120mH pot cores from Cirkit. Gain in all these circuits is not high but can be improved if required by the addition of a small low noise single transistor amplifier between the AF filter and the LM386.

Ceramic resonators are available from Radio Spares and Cirkit at low cost.

JAW-TYPE CURRENT PROBE

Ha-Jo Brandt DL1ZB
Lohensteinstr 7/B, W 8000 MUENCHEN 60. Germany

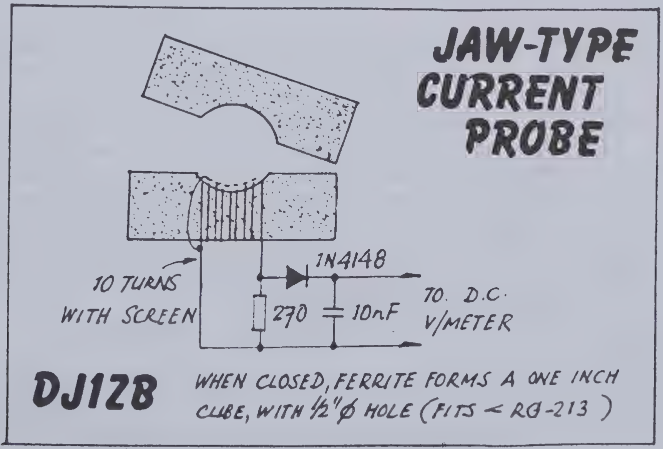
With interest I have read the contributions of GM4IJG and GM4JMU (SPRAT Nr. 51,52 and 71) on rf current probes. I am not so much interested in checking feeder currents, but to detect and measure rf currents around the shack and in the house installation to study EMC problems.

I wanted to avoid cracking a ferrite toroid, and therefore I have made use of split shield beads or sleeves originally designed for EMC purposes. I am employing a pair of Amidon 2X-43-151 cores (original FairRite Nr. 264164151). In spite of the fact that the 43 material is mostly used for EMC purposes it is also well suited for transformers, baluns, and VSWR meters in the hf range - and for current transformers. 10 turns on such a core will give an inductivity of about 150 uH. Therefore this coil will have a reactance of about 1400 ohms at 1.5 MHz. Measurements have shown that such a current transformer becomes frequency independent if the coil reactance is at least 5 times the parallel resistor (up to a frequency range where the coil will show self resonance). Therefore this coil, with a parallel load resistor of 270 ohms, will work fine as a current probe from 1.5 to about 30 MHz. To avoid capacitive coupling, a thin copper foil may be placed over the coil and insulated with tape.

It is even possible by simple means to determine the rf current in a wire which is fed through the closed core. If the current were 100mA with 10 turns, then the current in the secondary would be 10mA and voltage drop across the 270 ohms resistor 2.7 volts. This voltage can be rectified and measured by usual means (with the typical home brewer's problem of an inaccuracy between rms and peak values).

One problem that I will leave to the reader is the mechanism to open and to close the jaw. For my first experiments it was sufficient to employ a tape to glue both halves of the core together. A final solution should contain a hinge and a spring to pull both core halves together during measurements.

PS:
As I know that members in the UK may have trouble purchasing less popular Amidon parts, a similar core is manufactured by Steward (USA) under the part number B 2024-000, material 28, and should be available in the UK from Chomerics (UK) LTD, Parkway, Globe Park, Marlow, Bucks, SL7 1YB, Phone (0628) 486030, (according to a catalogue).


JAW-TYPE
CURRENT
PROBE
1N4148
10 TURNS
WITH SCREEN
270
10nF
TO. D.C.
V/METER
DJ1ZB
WHEN CLOSED, FERRITE FORMS A ONE INCH
CUBE, WITH ½"ø HOLE (FITS < RG-213)

A HIGH PERFORMANCE DIRECT CONVERSION RECEIVER

USING AN ACTIVE PRODUCT DETECTOR

Roelof Bakker PA0RDT, Esdoornlaan 11, 4334 CC Middelburg, The Netherlands

This receiver follows the normal dc-receiver format: preselector, rf.-amplifier, product detector, audio filter, audio interstage and final amplifier and of course a local oscillator.

PRESELECTOR

The preselector is patterned after an idea offered by Wes Hayward, W7ZOI in a Ham Radio article. The insertion loss is smaller than 3 dB and varies very little over a 12 frequency range. Component values are given in table 1.

RF. AMPLIFIER

A monolithic microwave integrated circuit type MAR6 is used. It provides 20 dB gain. These devices are unconditional stable and easy to apply. If better IMD performance is needed a MAV11 can be used at the cost of a substantial higher current drain In that case the 560 ohm resistor should be changed to 100Ω.

PRODUCT DETECTOR

The product detector is built around a Plessey SL64400. High gain is achieved by intentionally not terminating this mixer. This has little effect on the IMD performance. T2 is an audio interstage transformer from an old AM radio. I tried various types, including a home made one wound on a high mu ferrite toroid. They all worked well with gain figures from 35-40 dB.

VOLTAGE FOLLOWER

The LF356 voltage follower presents a high impedance load at the output transformer of the product detector The output provides a proper termination for the audio filter.

AUDIO FILTER

The audio filter consists of one high pass and two switchable low pass filters. These filters were designed using data supplied by Stefan Niewiadomski in a Ham Radio article. The high pass filter attenuates frequencies below 350 Hz. The low pass filters feature some 80 dB stopband attenuation. 3 dB bandwidths of 1600 and 300 Hz are available. The CW filter benefits the lower pitch preferred by many operators.

AUDIO INTERSTAGE AND FINAL AMPLIFIER

Another LF356 serves as audio interstage amplifier. The gain is adjustable between 6 and 40 dB. With the "SET RECEIVER GAIN" control the overall receiver gain can be adjusted for a comfortable level and minimal hiss.

The audio final amplifier is a design by Wes Hayward W7ZOI. It delivers ample power for headphone reception. I also use a small speaker with excellent results.

LOCAL OSCILLATOR

This circuit is a bit uncommon as it uses a MC1648P oscillator chip. It has built-in AGC loop and delivers a constant output of O dBM (1mW) at 50 ohm, making it ideal for multiband operation. Component values can be found in table 2. I used NPO ceramic and polystyrene capacitors. After warm up, frequency stability was no major problem on any band 160 - 10m. C5/6 set the frequency. C9/10 and C7 control the band-spread. I used T-50-6 toroids for L5 but suitable Toko or Neosid pre-wound coils can be used as well. Trimmer capacitor C5 can then be omitted and the frequency set by the adjustable core of L5. The "FREQUENCY SHIFT" circuit is a great help in dodging QRM. If a CW signal is tuned in from the high side and an interfering signal appears on the channel place S1 in the "DOWN" position. For a beat note of 500 Hz the VFO shifts 1000 Hz down, so the audio image can be received. More often than not this channel is not disturbed by QRM. The 50K and 20K trimmer potentiometers should be adjusted for a frequency shift of twice the frequency of the preferred beat note.

Any other VFO can be used as long as it delivers 0 dBM or .225 V RMS in a 50 ohm load.

MEASUREMENTS

All measurements were performed on 7 MHz and the selectivity control was set for SSB reception.

Without pre-amplifier the MDS was -126 dBM. The sensitivity for 10 dB s+n/n was .25 uV. Two tone dynamic range was 95 dB (20 KHz signal spacing) and third order intercept point was + 16.5 dBM. AM detection -35 or 4mV. Without pre-amplifier this receiver is absolutely bomb-proof. But using one enables a better gain distribution.

CONSTRUCTION

I used modular construction following the various circuit diagrams. No PCB patters are available because I do not use any. Instead I use neat ugly construction with home made tinplate boxes with glass feedthrough's and RG 174 coax as interconnecting cable. VFO construction should be done as sturdy as possible. I use an Eddystone 898 dial which provides the luxury of a tuning rate of 4 KHz per revolution.

PERFORMANCE

I made a 9-band 160 to 10m DC-receiver using the circuits described above. My antenna is a 150 feet doublet with open wire feeders and an ATU. No overload or IMD has been observed on any band. I can listen on 40 at night and copy the JA's and VK's. The pre-amplifier seems not to do any harm. Selectivity is amazingly good. This receiver approaches the performance of my Drake R4C!
I hope these circuits will encourage other experimenters.

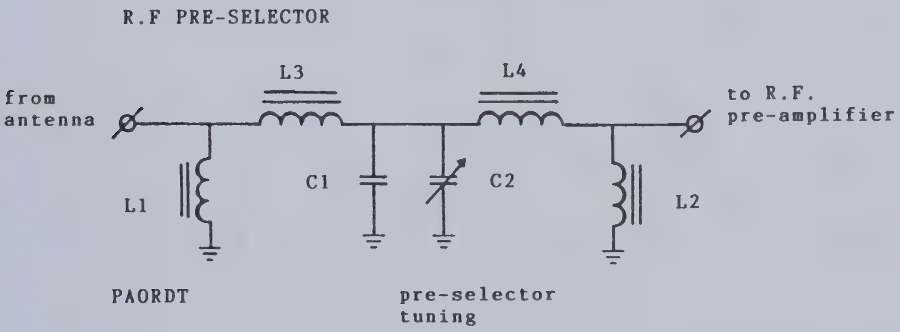
SPECIAL CLUB OFFER

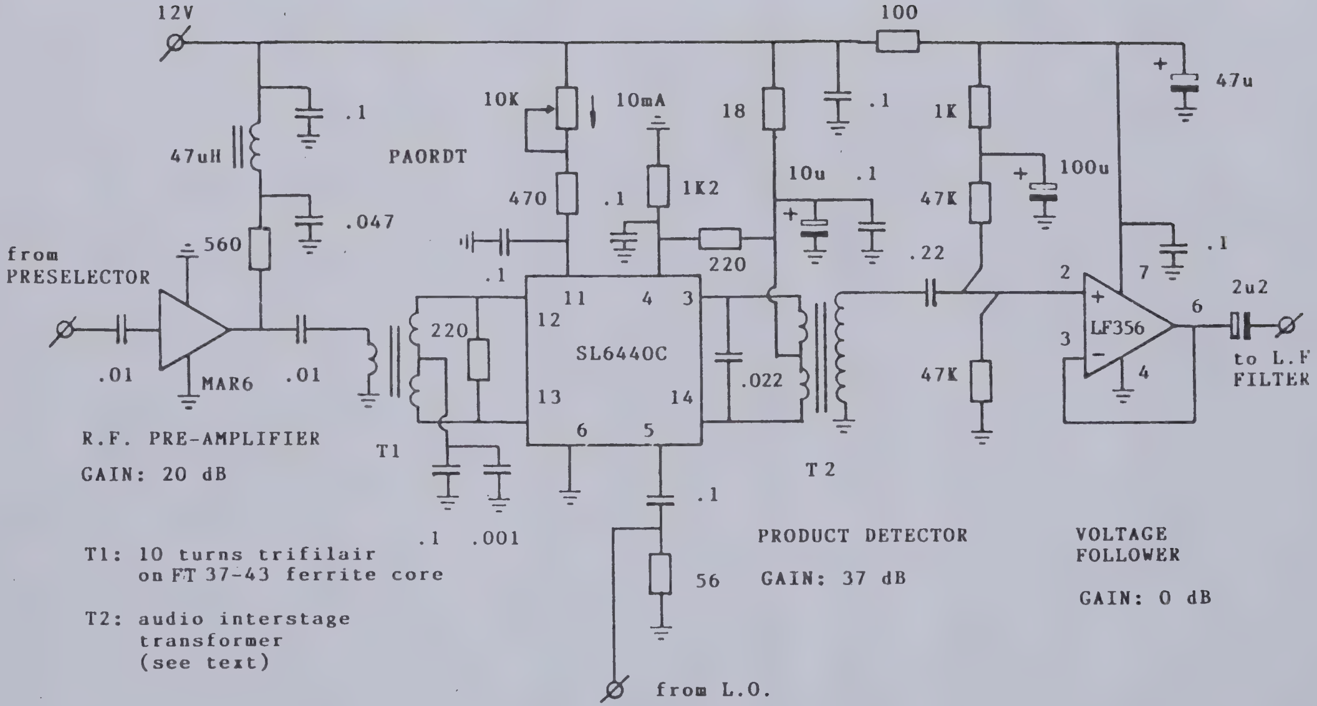
PLESSEY SL6440 MIXER

MEMBERS PRICE £2.00 [Less Than Half Price!]

[A DATA SHEET ON THE SL6440 CAN BE SUPPLIED FOR AN EXTRA 20p]

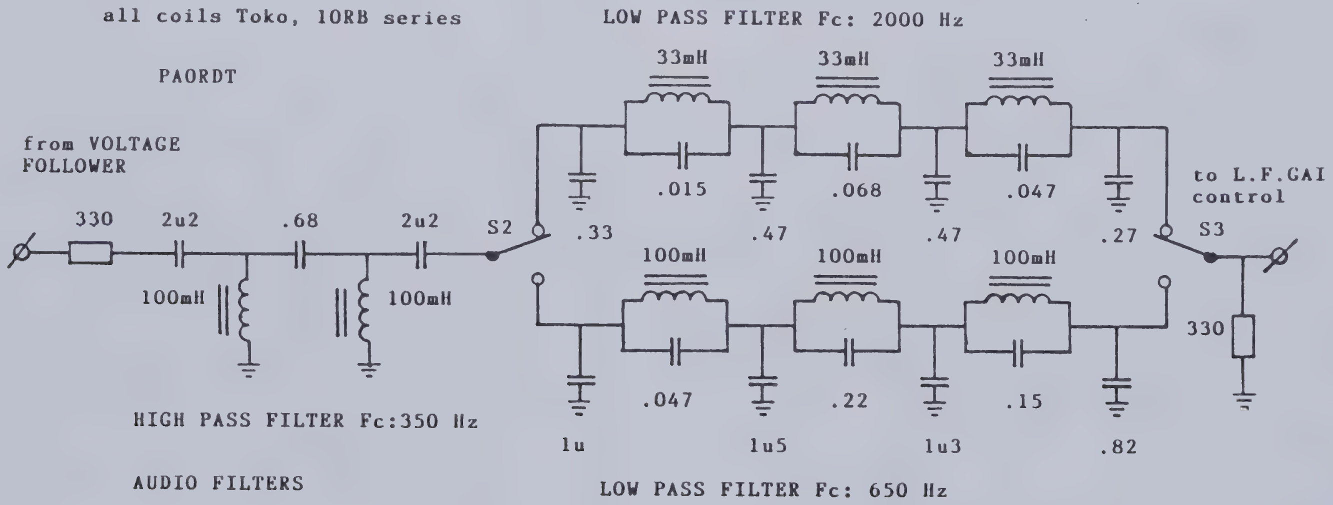
Send £2 + 50p postage + address sticker [Cheques : G QRP CLUB] to
David Aizlewood, G4WZV, 36 King St. Winterton,
Scunthorpe, South Humberside, N15 9TP



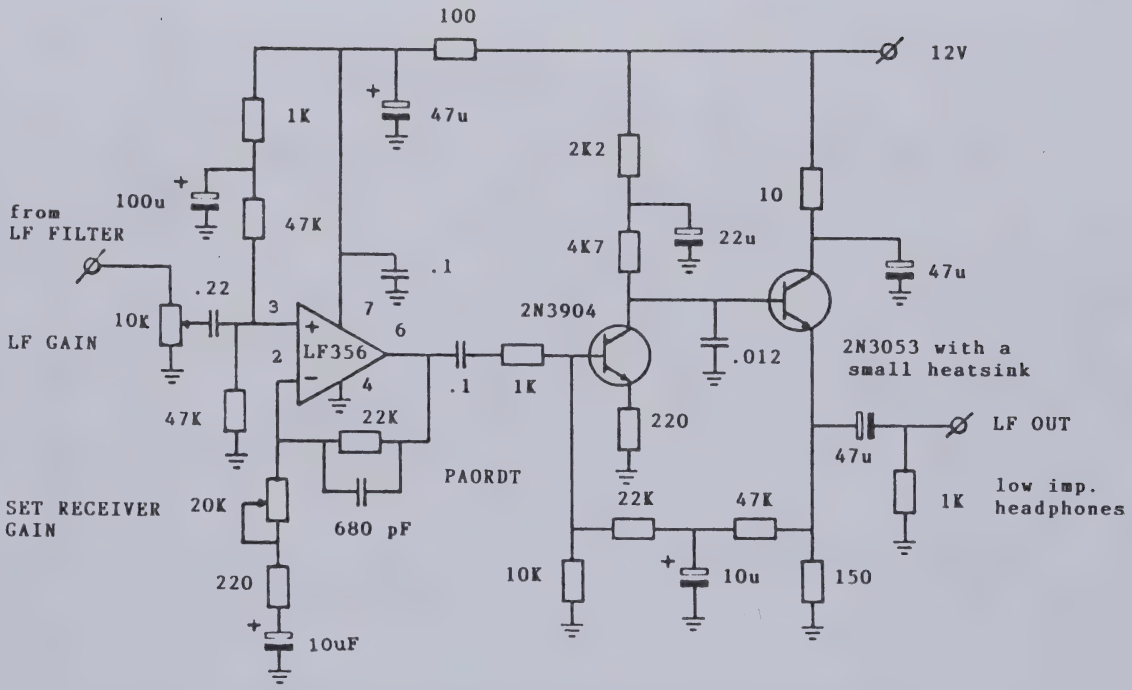


T1: 10 turns trifilair
on FT 37-43 ferrite core

T2: audio interstage
transformer
(see text)

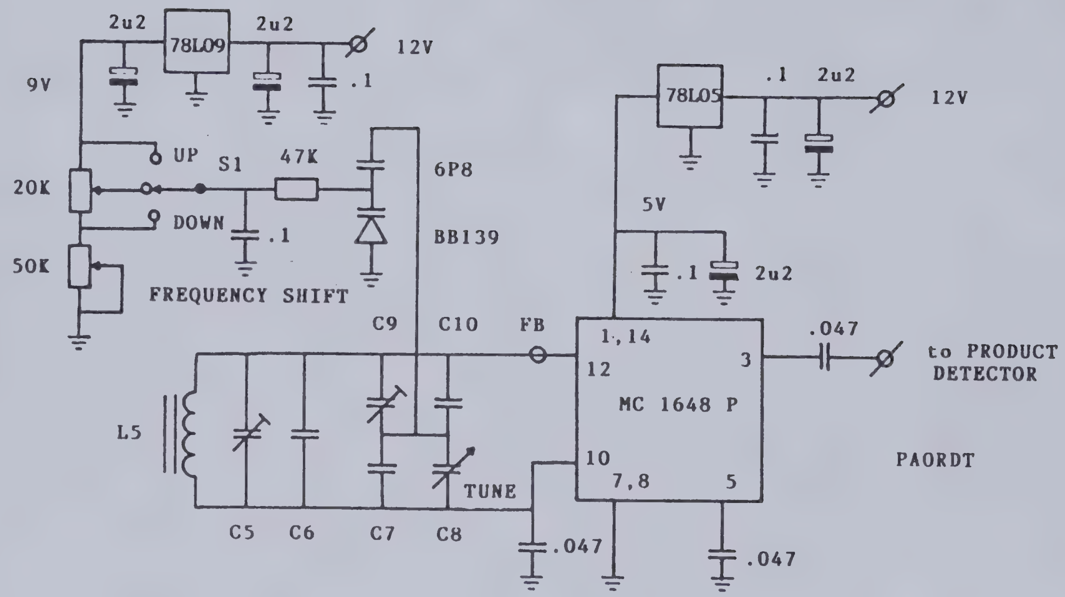


AUDIO FILTERS



AUDIO INTERSTAGE AMPLIFIER
GAIN: 6-40 dB

AUDIO FINAL AMPLIFIER
GAIN: 20 dB



LOCAL OSCILLATOR

BAND MHz	L1/L2	L3/L4	C1	C2 variable
1.8	.82 uh T 37-2 n= 14 .5 mm SWG26/AWG25 w.l. 20 cm, 8 inch.	10 uh T 50-2 n= 45 .3 mm SWG30/AWG28 w.l. 85 cm 33 inch.	1100 pf	300 pf
3.5	""	""	180 pF	300 pF
7	.2 uH T 37-6 n= 8 .5 mm w.l. 12 cm 5 inch.	2.5 uH T 50-6 n= 25 .5 mm w.l. 55 cm 22 inch.	270 pF	300 pF
10	""	""	---	300 pF
14	""	""	---	300 pF
18 - 30	.082 uH T 37-6 n= 5 .5 mm w.l. 10 cm 5 inch.	1 uh T 50-6 n= 16 .5 mm w.l. 40 cm 15 inch.	---	300 pF

TABLE 1 PRESELECTOR COMPONENT VALUES.

BAND	L5 uH	N	C5 var.	C6	C7	C8 tuning	C9 var.	C10
1.8-2	66	128	60	--	--	30	—jumper—	
3.5-4	21.5	73	60	--	--	30	—jumper—	
7-7.2	4.3	33	60	22	33	30	60	82
10-10.2	1.8	21	60	68	33	30	60	56
14-14.5	.79	14	60	82	22	30	60	68
18-18.2	.77	14	60	22	56	30	60	--
21-21.5	.51	11	60	39	47	30	60	33
24.8-25	.46	10	60	22	56	30	60	--
28-28.7	.35	9	60	22	47	30	60	--

L5: all coils T-50-6 toroids, all capacitors in pF

TABLE 2 LOCAL OSCILLATOR COMPONENT VALUES

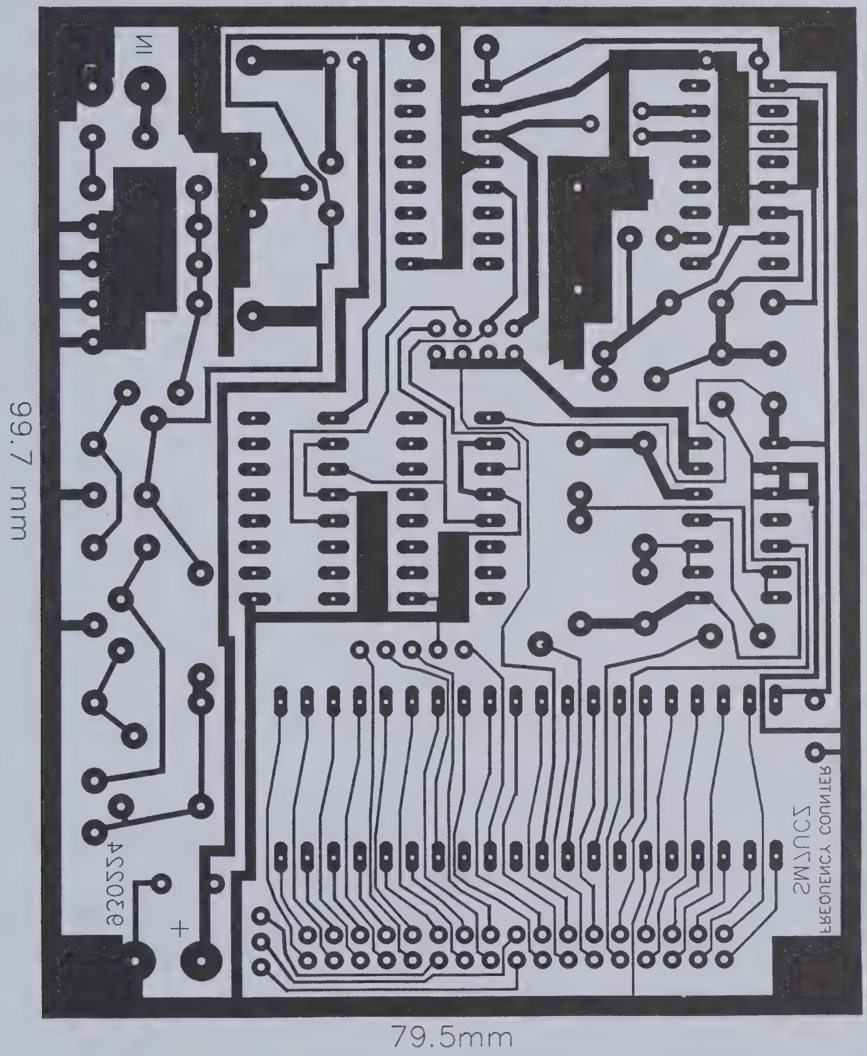
FREQUENCY COUNTER USING THE THE 7224 CHIP

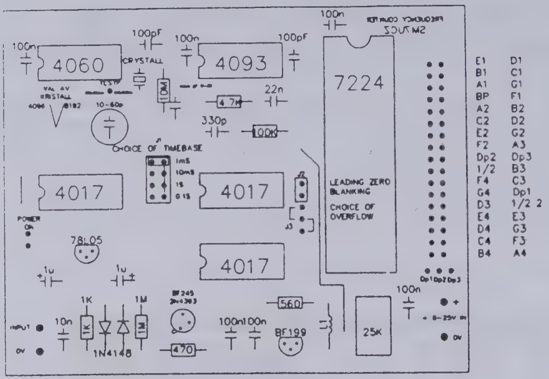
Johnny Apell, SM7UCZ, EKEDALSVÄGEN 11, S-373 00 JÄMJÖ. SWEDEN

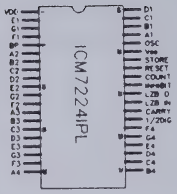
This is a 4½ digit counter with LCD display. The counter draws 15mA of which 13mA is from the two transistors. The sensitivity is about : 25mV to 5MHz, 50mV to 10MHz, 80mV to 14MHz and 300mV at 19MHz. My version worked to 23.5MHz : the factory guaranteed 15MHz for the ICM7224 but say most will work to 25MHz [naturally you lose the "2" over 20MHz]

The transistor, 2N4393 was in my junk box : I tried the BF245 and BF246 but the sensitivity was halved. Adjust the trimpot, R5, for best DC level for the input to the 7224. The counter is very useful for DC receivers.

I have all the drawings on AutoCad ver 12. if they are required : please send postage or IRCs







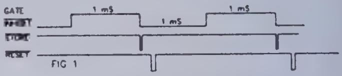
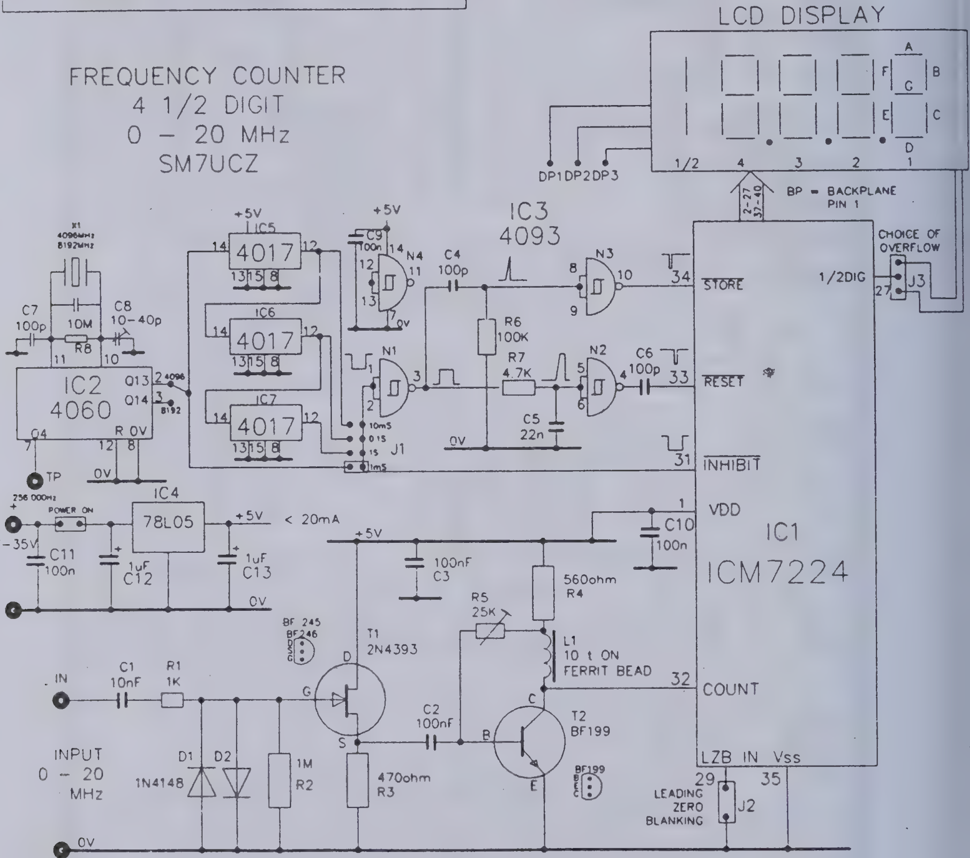


FIG 1

FREQUENCY COUNTER
4 1/2 DIGIT
0 – 20 MHz
SM7UCZ



A 10.7MHz SSB GENERATOR
Derek Pearson G3ZOM (JANDEK)

Fig 1 gives a block diagram of a system used to generate ssb. Audio from the microphone is amplified by a device known as a VOGAD (Voice Operated Gain Adjusting Device). This is an amplifier with AGC (Automatic Gain Control), so that its output signal is compressed, giving a higher average level; particularly useful for QRP work. The audio is then applied to a DBM (Double-Balanced Modulator) where it is mixed with a carrier from a CIO (Carrier Insertion Oscillator) to produce DSB (Double SideBand) and suppress the carrier. Output from the DBM is passed through a crystal filter to remove one of the sidebands, thus producing SSB (Single SideBand).

VOGAD (fig 2)

This function is performed by the SL6270C IC, the fet being added to provide a high impedance input. Low impedance microphones can be catered for by connecting a resistor of value equal to the required impedance across the input (shown as Rin). Capacitor Cd should be included across the input to decouple rf; its value ranging from 22nF for a 600ohm microphone to 100pF for a 100kilohm type. The sensitivity of the circuit can be controlled by adding a feedback resistor (Rf), maximum sensitivity being obtained when Rf is omitted. The value of Rf must not be less than 600ohms. High frequency roll-off is provided by C5. AGC attack and decay times are determined by C3 and R4.

CIO (fig 3)

This consists of two similar crystal oscillators and a shared buffer stage. Crystal frequencies are 10.7015MHz for lower sideband and 10.6985MHz for upper sideband, the required oscillator being selected by applying +12V to the appropriate supply pin (A or B). To set up the circuit, connect a 56ohm load resistor across the output of T1, set RV1 to mid-travel and adjust the core of T1 for maximum level across the output. RV1 should then be adjusted to give approximately 300mV rms output. Trimmers CT1 and CT2 are used to set the correct oscillation frequencies. Remove the load resistor when setting-up is complete. T1 is a TOKO type KACSK3892A and the three RFC's are each 3 turns of 30swg enamelled copper wire on a FX1115 ferrite bead.

DBM and FILTER (fig 4)

The DBM is the popular '1496' mixer IC, a favourite of mine because its performance can easily be controlled by the use of external resistors. The value of R3 determines the amount of audio input that can be handled, its value of 100ohms allowing up to 100mV peak (a value of 1k0 would allow 1V peak input). The buffer stage after the filter provides for a 50ohm output. T1 and T2 are TOKO types KACSK3893A and KACSK3892A respectively. The filter is an eight pole, 2.2kHz bandwidth, NDK type 10.7F2.2D. To set up the circuit, connect a 56ohm load resistor to the output of T2 and apply either a 10.7015MHz or 10.6985MHz carrier (300mV rms) to the carrier input. Adjust RV1 for minimum carrier signal across the load resistor. Apply a 1.5kHz sine wave signal (less than 100mV peak) to the audio input and adjust the cores of T1 and T2 for maximum rf across the load resistor. Remove the audio and re-adjust RV1 for minimum output. The load resistor can now be removed, but remember that, for correct operation, the output needs to 'see' a 50ohm (approx) termination from any circuit which follows it.

Once each module has been set up correctly, the system can be assembled and used to generate a very clean, yet 'punchy' SSB signal of up to 400mV peak across 50ohms (carrier suppression >50dB), which can then be mixed with a suitable vfo signal to produce an output on an amateur band

Each of the above three modules (inc pcb's, components and instructions) are available from JANDEK (for address see advert this issue): (Please add £1-00 for p&p)

VOGAD JD018 @ £7-60, CIO JD024 @ £9-95, DBM/FILTER JD025 @ £22-50

*** SPECIAL OFFER: All three modules for £36-00 (save £4-05) ***

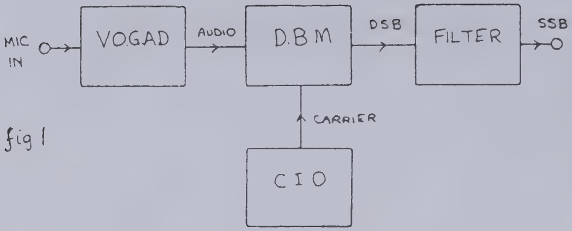


fig 1

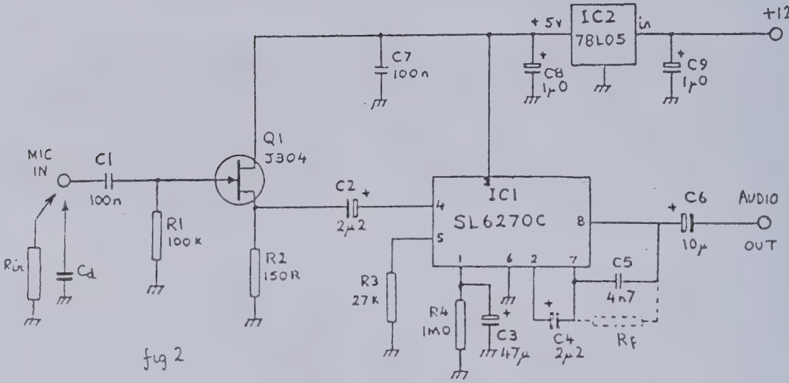


fig 2

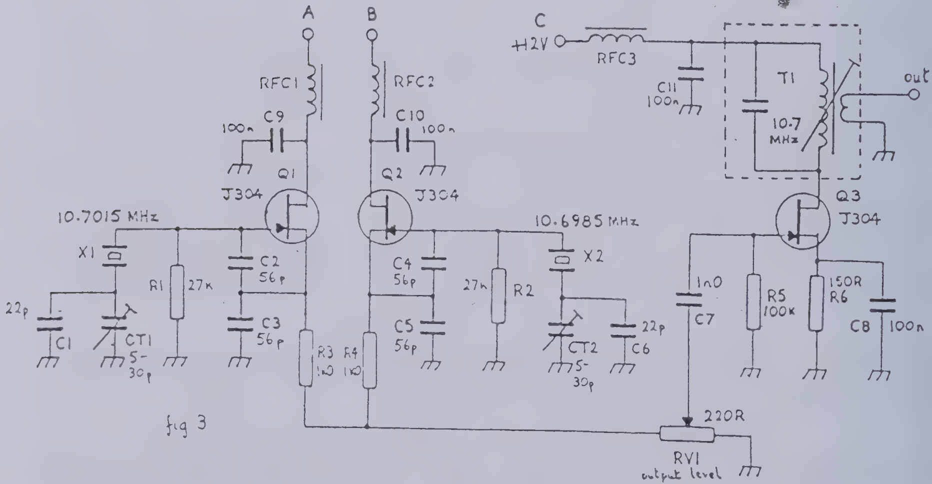


fig 3

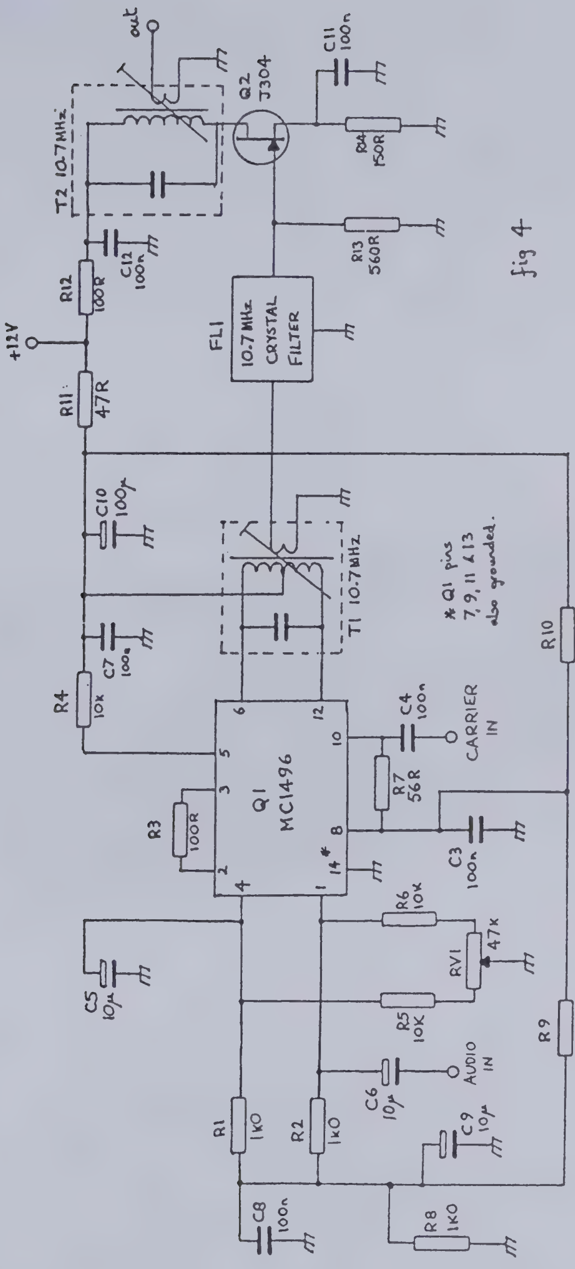

out
T2 10.7MHz
Q2
J304
C11
100n
R14
150R
R13
560R
R12
100R
C12
100n
+12V
R11
47R
FL1
10.7 MHz
CRYSTAL
FILTER
C10
100μ
T1 10.7MHz
* Q1 pins
7, 9, 11 & 13
also grounded.
R10
1K2
R4
10k
C7
100n
C4
100n
CARRIER
IN
6
12
5
10
3
Q1
MC1496
R7
56R
R3
100R
2
8
4
14*
1
C3
100n
R6
10K
RV1
47K
C5
10μ
R5
10K
R9
820R
C6
10μ
AUDIO
IN
R1
1KO
R2
1KO
C9
10μ
C8
100n
R8
1KO

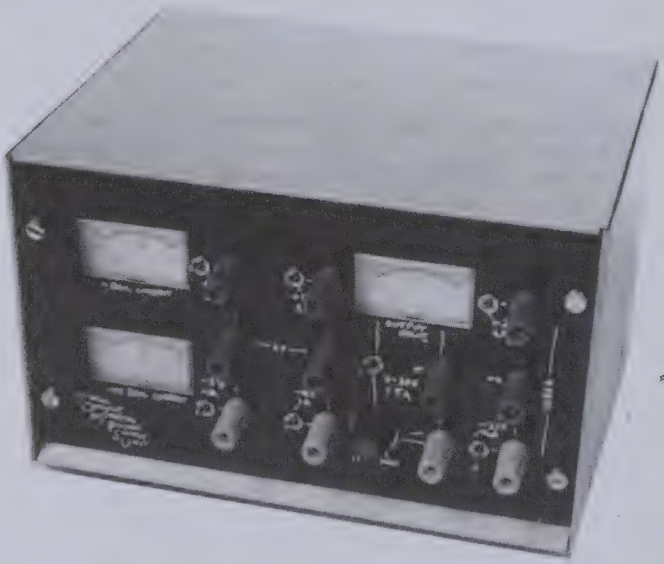
fig 4

THE TOM P.S.U. Ken Ruiz G4SGF

11 Crimicar Drive, Sheffield, S10 4EF

The TOM (Total Output Metering) PSU is a simple to construct and useful piece of equipment for virtually any constructor's shack providing one variable and several fixed voltage outputs. Its construction was inspired by various projects within the ARRL handbook. T0220 regulators are used throughout making it simple to construct, reliable, rugged and requires no setting up. Unusually for one of my projects, it worked first time! The usual warnings apply when dealing with mains - lid off only when not plugged in and capacitors discharged, and the case must be earthed.

After SPRAT 68 and 69 it might come as no surprise to learn the Tom is my younger son's name! Relax - I've NO more children or wives.



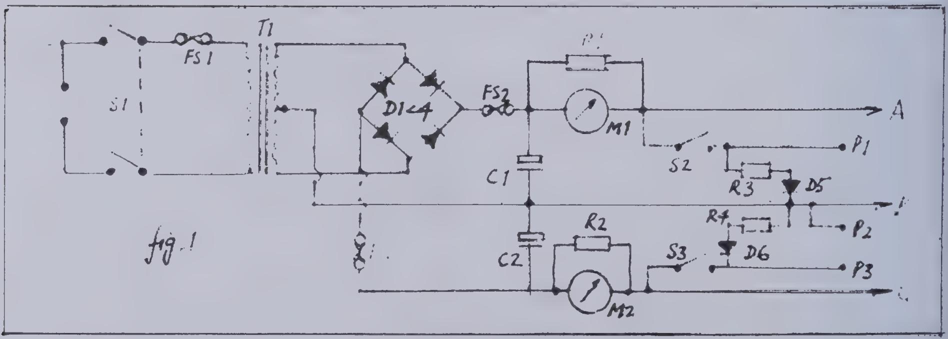


fig.1

The circuit diagram shows no fancy tricks are used. An IEC mains connector on the back panel included a mains switch and fuse holder. If like me you use a toroidal transformer use a slow-blow fuse here as the inrush current, though short lived, can be considerable. My transformer was a 0-15, 0-15V 120VA from Electrovalue. The rectifier was assembled on its own PCB with two fuses.
According to the formulas in the ARRL Handbook the smoothing capacitors in this circuit should be 2 x 3831uF. I used 2 x 4700uF taken from an obsolete piece of equipment I'd been given. Remember - if thou's owt for nowt keep it for thissen, as we say in Yorkshire. The meters (scrap purchase, £1 each) measure the total current flowing in rails A and c, hence the name.

Each regulator board is fused. Superfluous I know, but it makes me feel better. The 12-0-12 and 5-0-5 boards are identical in everything but the regulators used, and can be altered to provide whatever voltage output is required merely by change of regulator. if you choose higher voltages you'll need a higher voltage transformer also. Use heatsinks on the regulators. The variable voltage board includes a series diode as the off-load voltage from the transformer is just outside the quoted spec of the LM317 regulator. The voltage drop across the diode brings it to just the upper limit. I'm sure it would have been fine anyway, but there you are.
All the outputs are switched, and all have LEDs to indicate their state Dropper resistors have been calculated for 20mA in the LEDs. The variable voltage output also has a voltmeter connected permanently across it.

I used red terminal posts for the +ve outputs, green OV, yellow for --ve with re and yellow LEDs as indicators. The +5 and +rails can supply 2A each, the -5 and -12 A each. The variable output (0-30V) can deliver. 1.5A. The unregulated supply can give whatever the transformer is capable of. Incidentally, no part of the circuitry was connected to chassis.

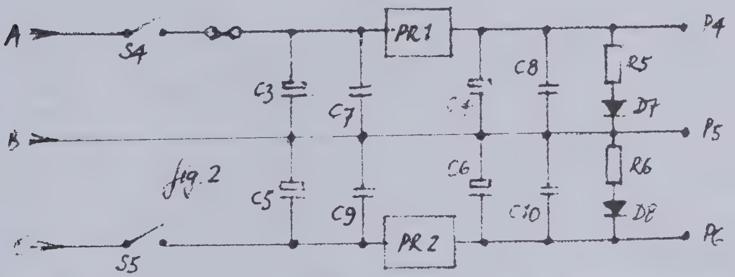


fig. 2

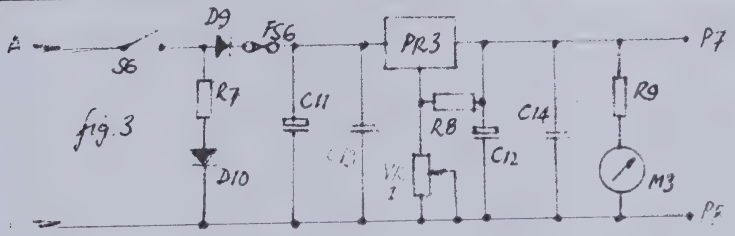


fig. 3

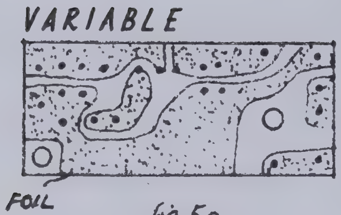


fig.5a

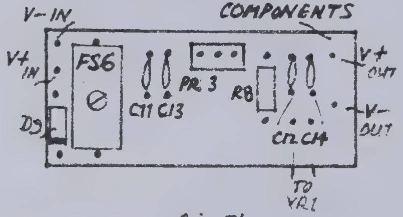


fig.5b

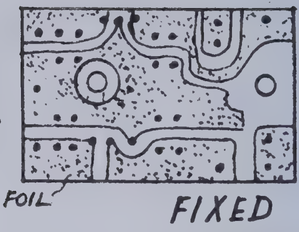


fig. 4a

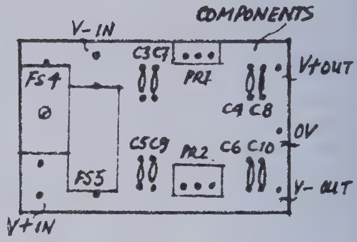


fig. 4b

TOM COMPONENTS

R1, 2	Shunt resistor to suit meter FSD 4-5A
R3,4	1K
R5,6	150R for 5V, 560R for 12V
R7	2k2
R8	220R
R9	Series resistor to suit meter, FSD 30V
VR1	5k lin
C1, 2	4700uF 32V (min) wkg elec
C3,4,5,6, C7,8,9,10	1uF 35V tant
13,14	10n ceramic
C11, 12	0.1uF 50V tant
D1,2,3,4	P600J
D5,7,10	Red LED
D6,8	Yellow Red
D9	Si diode, up to 2A capability
PR1	78S05 or 78S12
PR2	7905 or 7912
PR3	LM317

Fuse holders as required
IEC mains connectors
(inc, switch and fuseholder)
SPST switches as required
1 x knob
Case
3 x meters
LED holders as required
T12015 toroidal transformer
(Electrovalue)

P1,4,7	Red terminal post
P2,5	Green terminal posts
P3,6	Yellow terminal posts

Heatsinks for T0-220 regulators

FS1	3.15A slow-blow
FS2,3	6.3A
FS4	2.5A
FS5	1.25A
FS6	1.6A

40m. FIXED CAPACITOR XO SWITCHING G3FCK

'Mac' McNeil, 40 Turnpike Rd. NEWBURY. Berkshire.

As a VXO, a variable cap is relatively expensive, space-consuming and occasionally tends to go off oscillation when nearly, or completely unmeshed. Experimenting with the old idea of using switched, fixed caps produced a steady output, good note and positive frequency counter readings, and has been incorporated in the latest FCK 40m. rig.

All caps used are sub-miniature ceramic plate, tolerances being + 0.28% below and + 2% above 10pf. Cap tails are cut short and soldered to the Single Pole 12 way rotary switch contacts; the remaining long tails being twisted together, soldered and connected to chassis earth.
Xtals used were types HC25U, and the cost of all caps plus switch is less than £2. Results are shown in Table 1 and 2.

fig.1

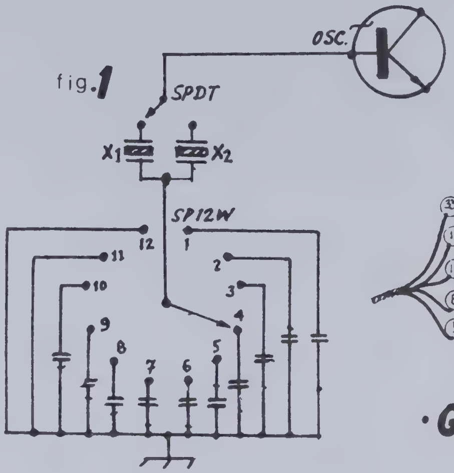
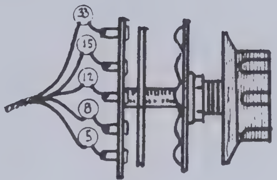


fig.2



·G3FCK·

TABLE 1 ——— VARIABLE CAPS

7.030X ONLY

VAR CAP	RANGE	COVERAGE
25p	7.029/7.034	5 KHZ
50p	7.027/7.029	2 KHZ
63p	7.028/7.031	3 KHZ
100p	7.028/7.030	2 KHZ

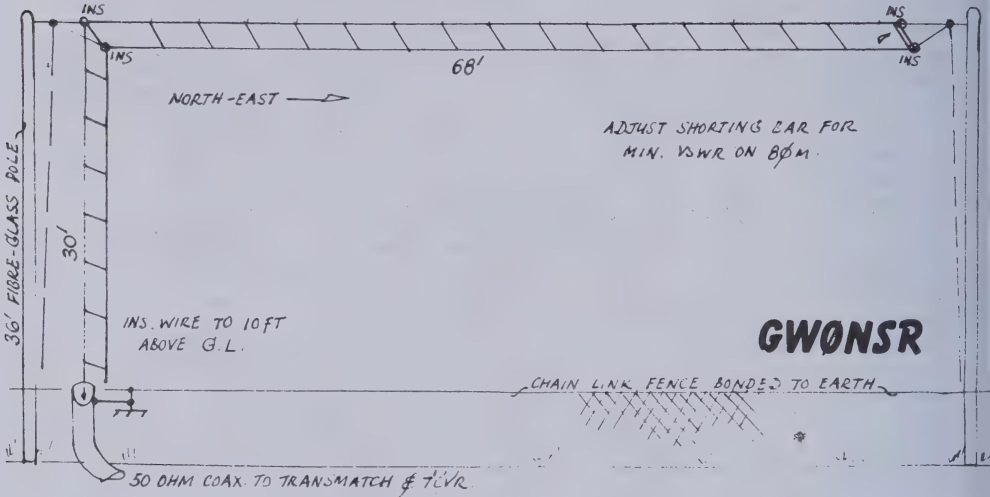
TABLE 2 ——— FIXED CAPS

FIXED CAP PF	7.025X D.F.C. READING	D.F.C. 4-FIG RESOLUTION	7.030X D.F.C. 4-FIG RESOLUTION	D.F.C. READING	SW POSN NO
470	7.024	.0234	.0267	7.027	1
47	7.025	.0245	.0281	7.028	2
33	7.025	.0249	.0285	7.029	3
15	7.026	.0259	.0298	7.030	4
12	7.026	.0263	.0302	7.030	5
8	7.027	.0270	.0309	7.031	6
5	7.028	.0277	.0316	7.032	7
4	7.028	.0280	.0320	7.032	8
3	7.028	.0284	.0324	7.032	9
2	7.029	.0290	.0329	7.033	10
NIL	7.030	.0301	.0340	7.034	11
NIL	7.030	.0300	.0339	7.034	12
COVERAGE	6.7 KHZ		7.7 KHZ	COVERAGE	

THE GW0NSR FOLDED MONOPOLE

Tony Tuite, 22, Gerddi`r Morfa, Conway, Gwynedd. LL32 8QL.

This antenna is made from 600 ohm open wire line, with a shorting bar at the far end which is adjustable for the best VSWR around 3510 KHz.. One side of the line is connected to the inner of the 50 ohm co-ax feeder, and the other side is left free. In my version the connection is made about 1 metre above ground to allow to allow the base of the antenna to clear the chain link fence. The outer of the co-ax is connected to a fairly extensive earth/counterpoise system which includes the chain link fence. The co-ax feeder is coupled to the rig via an antenna tuning unit. I use the antenna on 160, 80, 40, 20 and 15 metres. using 3 watts on 80m contacts include VK0, W6 and the South Americas, and on 40m PY0, ZS, XE, HC, 4K, ZD8 etc. The top could probably be bent to fit into a smaller garden, and scaled down versions might make a useful HF band antenna for restricted locations.


INS
INS
INS
INS
68'
NORTH-EAST
ADJUST SHORTING BAR FOR MIN. VSWR ON 80M.
36' FIBRE-GLASS POLE
30'
INS. WIRE TO 10 FT ABOVE G.L.
GW0NSR
CHAIN LINK FENCE BONDED TO EARTH
50 OHM COAX. TO TRANSMATCH & TCVR.

CLUB MORSE TRAINING TAPES

Currently we are in the process of remaking the tapes to confirm to the new Morse Test format and also changing the method of copying. The old originals are now of poor quality. An announcement about the future of the service will be made in the next issue of SPRAT

FRENCH CALLSIGN CHANGES

Some recent changes in French Callsign prefixes arrived too late to be included in the Members Handbook. The changes are as follows:
F, FA, FB calls - remain unchanged, FC calls drop the 'C' eg. FC1AXP is now F1AXP. FD1 and FE1 calls now become F5 eg. FD1DJJ is now F5DJJ and FE6 ADV is now F5ADV.

ANALOGUE SOLID STATE SPEECH RECORDER

Paul Lovell G3YMP
18 The Lindens, London. N12 9DJ

Over the past week, I've been experimenting with a speech recorder which uses neither tape nor digital technology! It's all done with an analogue storage device - the ISD1020A from ISD Inc, of California, USA.

A message of up to 20 seconds can be recorded and stored, and will be retained for up to 100 years after the device is powered down. The message can be played back at any time either singly, or as a continuous loop Fig 1 shows a circuit I have been using successfully, and Fig 2 is an alternative input configuration for electret microphones. The microphone input has a 20dB AGC range with the time constant set by the components on pin 19.

Frequency response extends to 2.7kHz and quality is well up to amateur communications standards. The speaker must have an impedance of at least 8 ohms, and there is a built-in audio amplifier which gives more than adequate volume for a 3-inch speaker. Do not exceed 6 volts maximum with this circuit - I got excellent results on 5V, but it's important to decouple the supply close to the IC supply pins (28 and 16). All unused pins should be left unconnected.

To record, change the R/P switch to low, with PD switch low and /CE high. Then bring /CE low and speak for up to 20 seconds. Playback involves setting PD high, then low again and switching R/P to high. Then a brief 'low' pulse on /CE will start the message playing.

Technology used in this device is similar to that of digital EEPROM chips but the individual cells are charged much more slowly The chip has an internal clock with filters on input and output, to reject the sampling frequency Numourous applications spring to mind such as an automatic CQ machine, or a device to test audio transmit and receive circuits, under conditions which need something more realistic than a single tone. The device could also appeal to repeater groups, and might have applications for operators who are blind. But above all it's a real fun little circuit to play around with!

The ISD1020A is available from ISD distributors in many countries, but in case of difficulty I can supply the chip at £19.95 (or $32.00 US) fully inclusive, to Sprat readers.

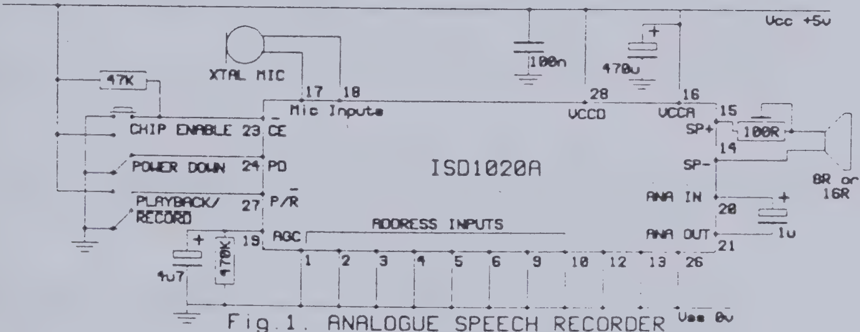


Fig.1. ANALOGUE SPEECH RECORDER
Paul Lovell G3YMP

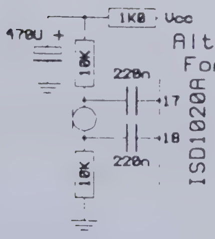


Fig.2.
Alternative Input
For Electret Mic

W6EMT 30m VXO TRANSMITTER

Roy Gregson W6EMT 13848 S.E. 10th, Bellvue. WA 98005. U.S.A.

I was looking for a simple QRP rig, something that I could put together from my "junk box". I had seen an article in SPRAT by Ha-Jo Brandt DJ1ZB that used a cheap computer crystal for a VXO in the 30 meter band that looked promising. With a little extra circuitry and a power MOSFET, the result is a simple rig with no bad habits that is stable, has good keying quality and covers the best portion of the 30 meter band. You can easily duplicate this rig using ugly construction, or vector board. A kit with a screened PCB is available mail order (see notes).
This an unusual transmitter design in that it's not only crystal controlled, but the VXO circuit gives more than 35 KHz frequency shift, most of the 30 meter band.

The unique features are:
--Crystal control --Covers 10100 to 10135 KHz --3.0 to 3.5 watts output --Inexpensive power MOSFET PA --Oscillator circuitry uses IC for simplicity --Tuned circuits use IF cans --Simple easy adjustments Excellent keying quality --Provision for companion receiver muting & antenna switching --A spot switch for finding where you are.

I found that the computer crystal made a very stable VXO oscillator circuit. The need for matched transistors in the frequency doubler circuit led to the choice of the IC transistor array. And as it turned out, the transmitter is fairly compact without crowding. The choice of the 10.7 MHz IF's for the tuned circuits was for simplicity and ease of duplication.
The PA uses an IRF510 power MOSFET. It is inexpensive, and easier to use than some of the bipolar power transistors I have used in the past. It seems to be immune to SWR mismatches, antenna shorts opens etc. It puts out plenty of power and doesn't have a mind of its own.

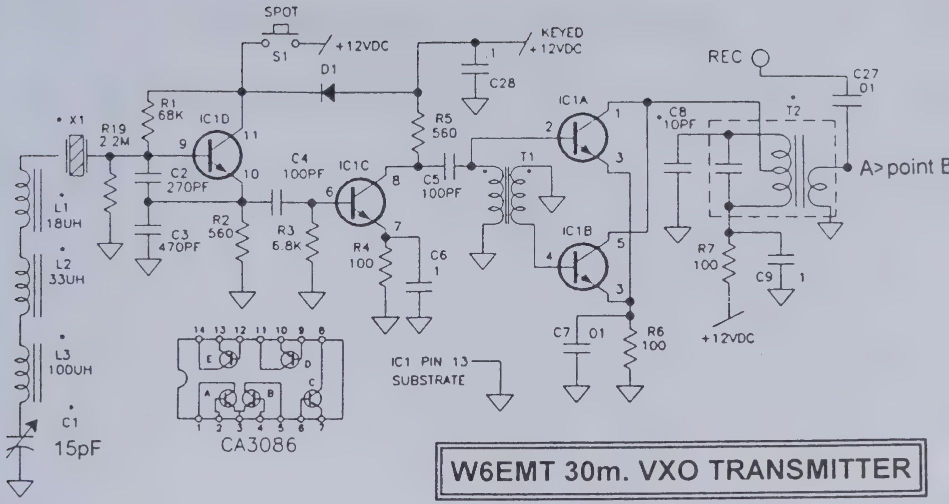
The keying is clean and shaped for the best sound on the receiving end. +12 VDC keyed output is provided for the control of a relay, keying a sidetone, muting a companion receiver etc. The spot switch is necessary to put the transmitter on the received station frequency. This has a decided advantage over a QRP transceiver when a DX station is listening higher in frequency. With a separate receiver, you have wide range RIT.
It is important that a proper heatsink be provided for the PA transistor. A 2" x 2" aluminium square would be fine. But remember that the centre drain lead and the mounting tab are internally connected and are at a 12vDC and RF potential.

Connect a voltmeter to TP2 and ground. Temporarily connect TP1 to ground. Apply 12V, key the transmitter, and adjust R14 for 4.5 volts on the voltmeter. This sets the proper bias for the IRF510. Disconnect the voltmeter and ground connection to TP1. Connect a 50 ohm dummy to the transmitter output. Key the transmitter and tune T2 & T3 for maximum output.

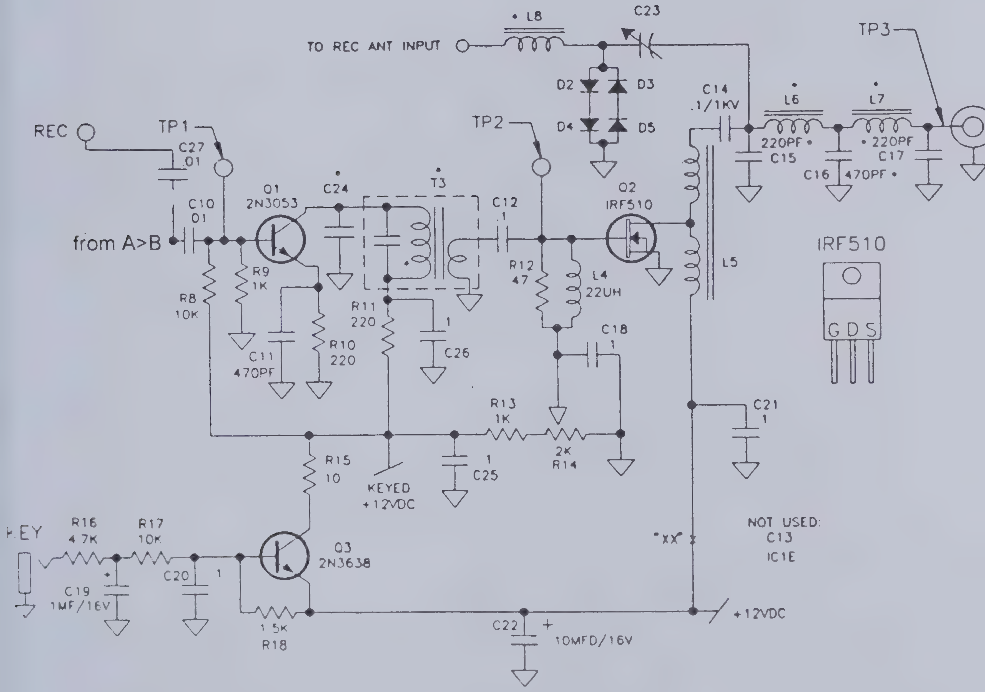
It may be necessary to adjust L6 and L7 by squeezing together or spreading apart the turns to obtain 3 to 3.5 watts into a 50 ohm load.
Assuming you have interconnected the antenna circuit to a receiver, tune in a station and peak C23 for maximum volume. This completes the transmitter tune-up.

Operation is simple It's just like the old days of separate transmitters and receivers. Just tune in the station you want to call, press the spot switch and tune the transmitter to the same tone (high side, right') You will hear your transmitter in the receiver for a side tone.

I hope you have as much fun with this rig as I have, if you hear me on 30m, give me a call ...



W6EMT 30m. VXO TRANSMITTER



A PARTS KIT WITH SCREENED PCB IS AVAILABLE FOR $29.95 FROM:
DAN'S SMALL PARTS AND KITS, 1935 SO. 3rd W. #1, MISSOULA. MT 5901 U.S.A.
PHONE / FAX : 1 - 406 - 543 2872

W6EMT VXO 30m TRANSMITTER
Component Listing

ALL RESISTORS ARE 1/4 WATT
R15 -------- 10 OHM
R12 -------- 47 OHM
R4,R6,R7 --- 100 OHM
R9,R13 ----- 1K
R8,R17 ----- 10K
R18 -------- 1.5K
R10,R11 ---- 220 OHM
R2,R5 ------ 560 OHM
R16 -------- 4.7K
R3 --------- 6.8K
R1 --------- 68K
R14 -------- 2K POT
R19--------- 2.2MEG

CAPACITORS
C8 --------- 10 PF DISC CER
C4,C5, ----- 100 PF "
C6,C9,C12,C18,C20,C21,C25,C26,C28,C6--.1 MFD
C14 -------- .1MFD DISC CER 1 KV
C7,C10,----- .01 MFD "
C3,C11 ----- 470 PF "
C2 --------- 270 PF DIPPED MICA 500V
C16 -------- 470 PF "
C15,C17 ---- 220 PF "
C19 -------- 1 MFD 16V ELECTROLYTIC
C22 -------- 10 MFD 16V "
C23 -------- 35 PF TRIMMER
C1 --------- 15 PF VARIABLE MAIN TUNING

INDUCTORS
L1 -------- 18 UHY MOLDED
L2,L4 ----- 33 UHY "
L3 -------- 100 UHY "
L5 -------- 7T BIFILAR FT50-43 #24
L6, L7 ---- 18T T37-6 #26
L8 -------- 40T #34 T37-2
T1 -------- 7T BIFILAR FT37-61 #24
T2, T3 ---- MOUSER 421F-128 10.7 IF'S GREEN CORE

SEMICONDUCTORS
Q1 --------- 2N3053 NPN
Q2 --------- IRF510 POWER MOSFET
Q3 --------- 2N3638 PNP
IC1 -------- CA 3086 IC TRANSISTOR ARRAY
D1-D5 ------ 1N4148 DIODES

MISC 1EA -- 5.0688 CRYSTAL, KEYJACK, 14 PIN IC SOCKET, SPST PUSH-BUTTON SWITCH

A 50 MHz EXCITER

Peter Brodribb G3ONL
20 Ipswich Rd. Debenham, Stowmarket. Suffolk IP14 6LB

The circuit is built around a symmetrical mixer, the S042P. This integrated circuit acts as an oscillator whose frequency, 42 MHz is determined by the overtone crystal X, and as a mixer. The second frequency, 8 MHz is determined by the VFO T1 and Buffer T2. The sum frequency, 50 MHz is passed to the tuned circuits L3 and L2 and associated capacitors. The difference frequency is rejected. The two input frequencies, 8 MHz and 42 MHz are suppressed by the S042P. The VFO frequency may be adjusted to suit other values of X but if X is more than 45 MHz the difference frequency will be more than 40 MHz and may be difficult to remove by L2 L3. The construction of L2 L3 shown in Fig. 2 lends itself to easy shielding. Alternatively two separate formers may be used spaced about 8mm to give critical coupling. Fig 3, T1 is made from two ferrite beads glued together. A suitable twin-hole bead may also be used. My exciter was constructed on Stripboard. PC board should prove equally successful. I have also used a wide range VXO with equal success (SPRAT No 72) instead of the VFO but of course with less frequency swing than the VFO. The output is about 150mV into 100 ohms.

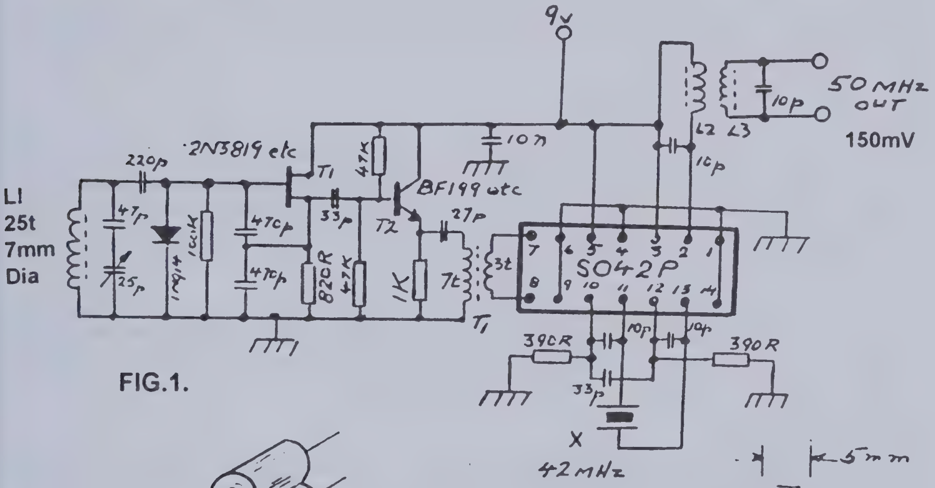


FIG.1.

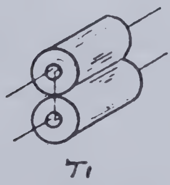
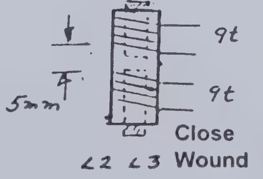


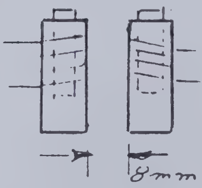
FIG.4.



Close Wound

FIG.2.

FIG.3.



50MHz EXCITER
G3ONL

SOME IDEAS ON KITE CARRIED AERIALS

Oliver Borkowski, DF6MS,
Kipfenberger Strasse 22, EICHSTATT 85072. Germany

There is no question that QRP work is more fun outside the ham shack in the open country but more often than not it is not easy to erect an effective aerial just for a couple of hours' work. Flying a kite with a random length of wire on it and trying to match it with an ATU will almost every time lead down the path of trouble. This system requires, in any case, a network of quarter wave radials (at least two for each band) or a low-loss connection to a "real" radio ground. Moreover, it is not at all an effective way to have the kite flying hundreds of feet up only to lift a poor 20m wire for quarter wave operation on eighty....

A far better way is to elevate a whole resonant "vertical Zepp" array, i.e. a 41 m radiator and an 18m open feeder as a unit. The radiating part of this aerial is well up in the air and the well-know tuning procedure allows easy multi-band operation. Of course, the wire will almost never be totally vertical but this does not seem to affect the radiation pattern at all. This simple method offers much fun and is really serviceable. With the lengths indicated, outstanding results have been achieved on 40, 30 and 20m (standard RST 589 from DL on forty, nearly every call being answered - with two watts output only!); 80m and top band are hard to work during the day, the wind usually settles in our area at sundown. (Lucky are the hams who live by the sea....)

The procedure to go on/in the air is quite simple:

- Have your radio ready for operation. Launch the kite and allow it to reach an altitude of, say, 40-50 metres. If there is no steady lift (the kite should 'like' to take line right from the reel), wait for better conditions or call it a day. There is no chance of successful operation if the wind is not strong enough; better have a number of kites ready, a light wind one for any kind of wisp, a selection of medium grade ones, and even a strong one for the worst case, hi....

- If everything is okay so far, attach the top end of the aerial wire to the kite string (with a fishing hook in a rubber ring fixed to the string; (these precautions are a must since the wire has to be released by a single jerk in case of emergency!) Let the kite go on climbing, taking up the wire from its own reel. Then fix the bottom end of the wire to the kite line, too. Allow some slack of the wire because the kite line might stretch.

- Now fix the top end of the feeder to the string and connect one end tightly to the aerial. Reel off the kite string until the feeder is also up in the air completely. Secure both the kite string and the lower end of the feeder to the ground as close together as possible, connect the feeder to the radio and you are ready to go!

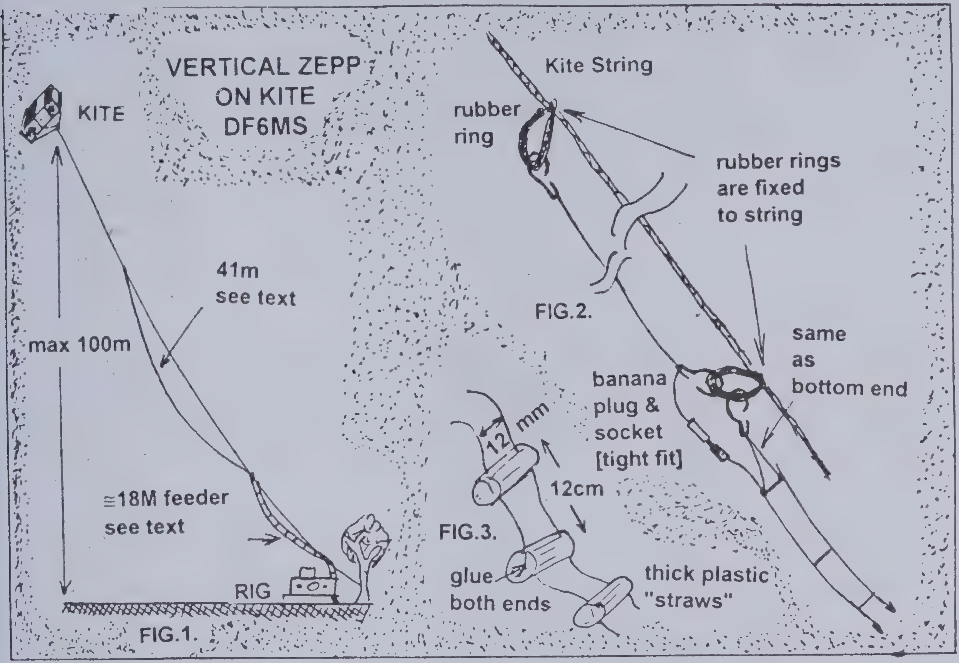
- Be sure that you can always pull down the whole wiring if something goes wrong (thunderstorm, approaching aircraft etc.) Never use solid metal or stranded wire as a part of the line itself.

The entire aerial should be as light-weight as possible. I found thin stranded wire for both parts of the aerial most useful, the feeder made of plastic "straw" spreaders. The pictures show KL2MGP on location with one of the kites, the rig, and showing the feeder construction.

I have found the whole procedure quite easy and reliable in its results; most of the problems concerning the kite and wind conditions rather than the wires on it.
Expert kite fliers know about the troubles caused by irregular air currents, changing wind directions, unsettled conditions and many more feats which can make a kite perform most extraordinarily. The best way to escape breath-taking stunts and a damaged and broken kite is to make friends with it and its facilities. If you don't think you will be able to make a kite by yourself, ask for assistance. If you buy a

kite, try and fly it a number of times top make sure you can really control it. There are some excellent books about kites and kite making available.

I am always looking out for information concerning this topic; so far, there is but little I've found yet. Please let me know if you know something about it, especially about types of kite covering a wide variety of wind speeds. Box kites are very well in strong winds, deltas and plane-surface systems perform well in light winds - what we need is some sort of universal or multipurpose kite.



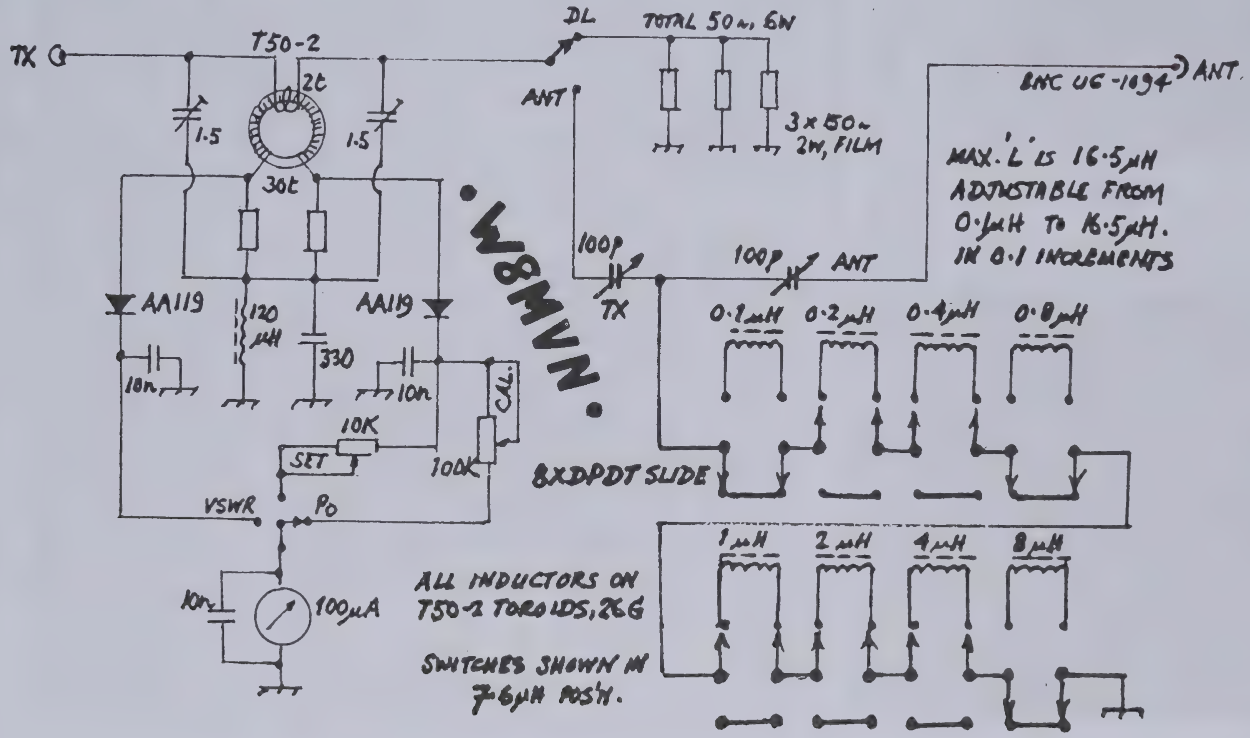
RIGHT: Radio Kite No. VII Rhombus 50x50

BELOW : The Open Feeders

A QRP ANTENNA TUNER Ernest M. Helton W8MVN

36 Walnut Street, Franklin, Ohio 45005. U.S.A.

A variation on the switched inductance T Match Tuner from W8MVN. The Tuner uses slide switches to obtain inductance values from 0.1uH to 16.5uH in 0.1uH steps. All inductors are wound on T50-2 toroids.



THE MINICOM SUPERHET RECEIVER

Basil Dale VK2AW

From LO KEY the Journal of the VK CW Operators' QRP Club

CONCEPTS

An Outline of a simple minimum components receiver for amateur communications was given in LO-KEY No. 35 September 92 (1). This receiver is based on articles in QST (2) and SILICON CHIP (3) but uses the Motorola integrated circuit 16-pin MC3357 instead of the 18-pin MCX3359. The MC3357 contains a mixer, an oscillator which can be configured with external components as a Colpitts, a Hartley or crystal controlled, and five stages of IF (limiters). The other features of the chip, the quadrature detector, audio stage and squelch are not used. An on-chip audio filter is available and details are given in case its use is desired.

The MC3357 has been around for many years in use in quality FM receivers. It has one advantage over the MC3359 - there is an output from the IF (limiter) stages at pin 7 and this is important for the purposes of this receiver.

Four versions of the receiver (dubbed "MINICOM" = MINImum number of COMponents) can be suggested:

1. CW/SSB superhet for any amateur band, 455 KHz IF using a Murata or similar ceramic IF filter (or two or more in series) or multiband using plug in or switched mixer and oscillator coils.
2. Dual band CW/SSB superhet, no switching, for 3.5 MHz and 14 MHz using a 9 MHz crystal ladder filter and 5 MHz on-chip oscillator (band imaging);
3. CW/SSB superhet for any single band, 9 MHz crystal ladder filter and suitable oscillator frequency e.g. 2 or 16 MHz for a 7 MHz receiver, or a multiband receiver using plug-in coils or switched coils for mixer and oscillator.
4. General coverage AM receiver for short-wave listeners, 455 KHz IF using single Murata or similar ceramic filter and a diode AM detector. Mixer and oscillator tuning could be 300 to 400 pF capacitors to give extensive coverage over desired bands.

These are very simple but effective receivers with a minimum component count.

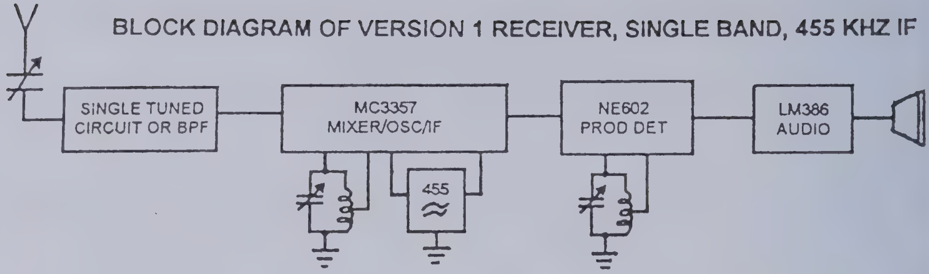
CIRCUIT DESCRIPTION

The desired signal enters the mixer at pin 16 via a trimmer capacitor (adjusted to give the optimum signal level) and a coupling coil. Both the 3359 and 3357 ICs are susceptible to over load from strong HF signals particularly when connected to a resonant antenna or antenna via ATU. The mixer is coupled internally to the on-chip oscillator, which uses the Hartley design, by an external tapped coil. This is a stable oscillator and the capacitor across the coil (main tuning) is selected to give the required frequency coverage. Details of coil winding and capacitor values are not given, as individual constructors will have their own preferred components. The Hartley oscillator is preferred to the usual Colpitts with fixed capacitors, as these have to be changed for each frequency if a multiband receiver is required. The simple approach is to use a tapped coil (25% of total turns from ground end is usually satisfactory).

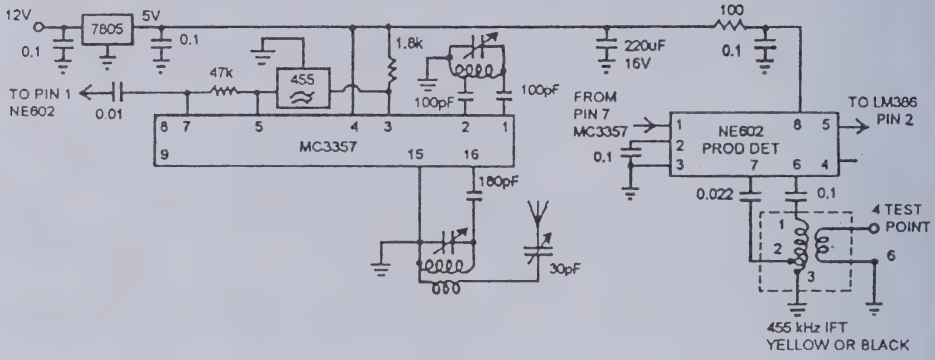
The mixer output at the intermediate frequency (IF) is taken from pin 3 to the IF filter, the output of which connects to pin 5 which is the input to the five stages of IF. The IF output at pin 7 enters an NE602 product detector/BFO for CW/SSB versions or a diode for the AM version. The NE602 circuit is the standard configuration, using, in the oscillator, either a 9 MHz crystal or a miniature IF transformer (455 KHz version). An alternative for the 455 KHz version is to use an orange 2-pin ceramic resonator (Tandy Electronics) or similar which will oscillate at 455 KHz. Audio output from the 602 is taken from either pin 4 or 5 to the LM386 audio IC. When using 455 KHz IF, the gain of the 5 stage limiter is reduced to prevent overloading from strong HF signals by omitting the by-pass capacitor from pin 6 of the MC3357.

The gain of the LM386 audio IC may also be reduced if required by omitting the usual 5 uF to 10 uF capacitor between pins 1 and 8, as the overall gain of the 455 KHz version is adequate. A speaker or phones may be used. If an audio filter is desired, one is available on the 3357 (circuit shown) or a Bessell filter centred on 700 Hz (as per Reference 4) can be applied to the two inputs of the LM386.

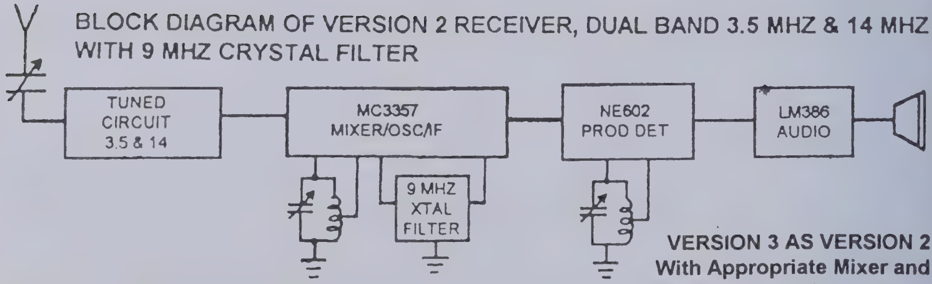
BLOCK DIAGRAM OF VERSION 1 RECEIVER, SINGLE BAND, 455 KHZ IF



CIRCUIT DIAGRAM OF VERSION 1 RECEIVER

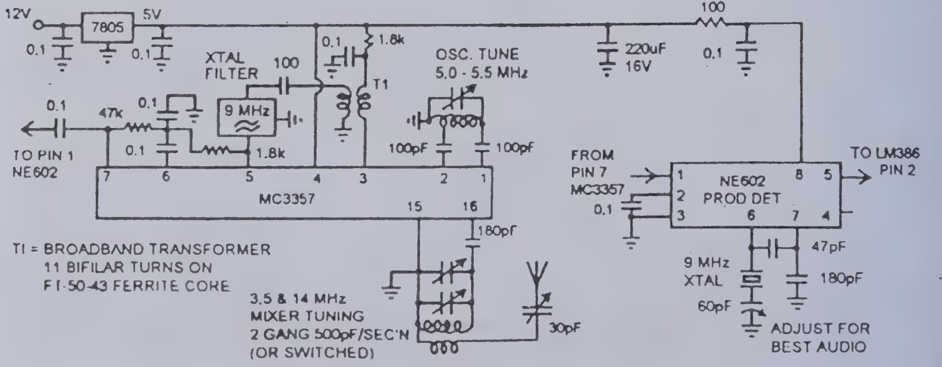


BLOCK DIAGRAM OF VERSION 2 RECEIVER, DUAL BAND 3.5 MHZ & 14 MHZ WITH 9 MHZ CRYSTAL FILTER



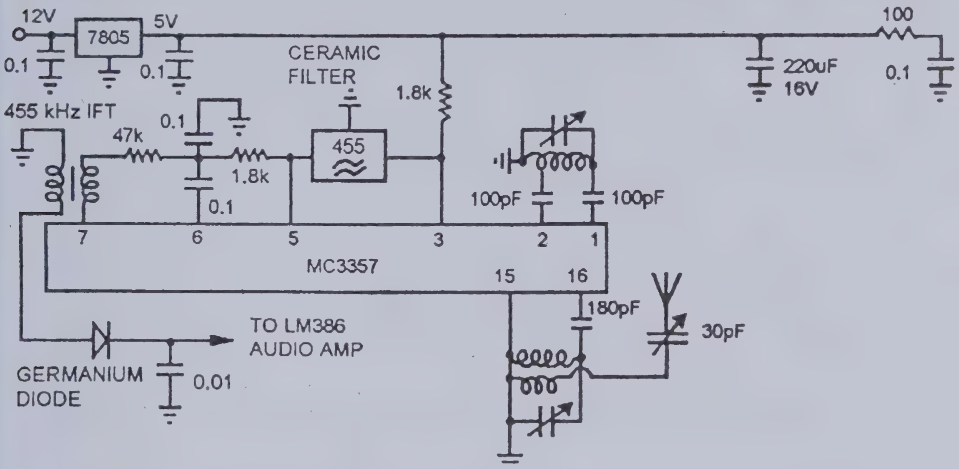
VERSION 3 AS VERSION 2
With Appropriate Mixer and
Oscillator circuit constants

CIRCUIT DIAGRAM OF VERSION 2 RECEIVER



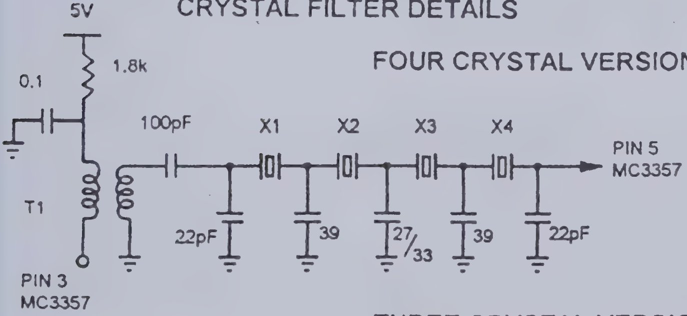
VERSION 4 RECEIVER -
GENERAL COVERAGE AM RECEIVER FOR SHORT WAVE LISTENING

This version has not been built. The schematic diagram would be the same as Version 1 but with the additional circuitry around pins 5,6 and 7 (bypassing pins 5 and 6 with 0.1 uF capacitors to give increased gain) and connecting pin 7 of the MC3357 to a diode detector. The NE602 is omitted and as this has a gain of 15 db it may be necessary to increase audio gain with an extra stage. A suggested circuit is shown:



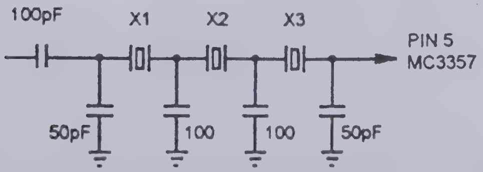
CRYSTAL FILTER DETAILS

FOUR CRYSTAL VERSION



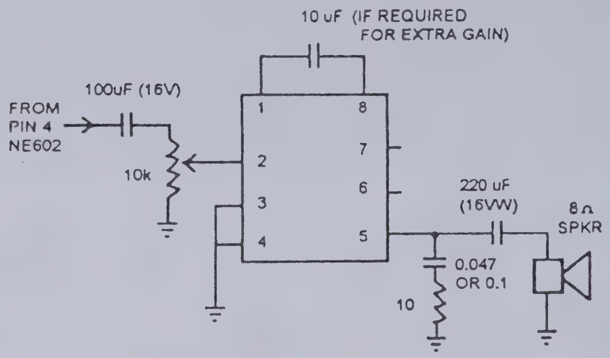
X1 - X4 = 26 680 kHz
USED ON FUNDAMENTAL
8 893.5

THREE CRYSTAL VERSION

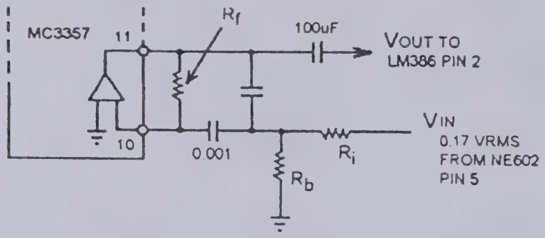


X1 - X3 = 27 135 kHz
USED ON FUNDAMENTAL
9 045 kHz

LM386 AUDIO STAGE USED FOR ALL VERSIONS

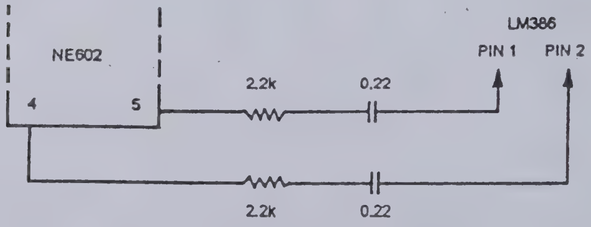


OPTIONAL AUDIO FILTER (USES MC3357 - SEE REFERENCE 2)



For a Q of 8 and gain of 8 at 700 Hz
R_f = 1.8 megohm R_i = 110k R_b = 7.5k

ALTERNATIVE OPTIONAL AUDIO FILTER
(USES NE602 - SEE REFERENCE 4)



VK CW OPERATORS QRP CLUB : **Applications or information about membership to Kevin Zietz, VK5AKZ, 41 Tobruk Ave. St. Marys, SA 5042. Australia.**
Subscriptions : VK: $A10, ZL: $A12, DX: $A14.

CRYSTAL FILTER

For many years, the half lattice or full lattice type crystal filter was predominant in amateur literature. Commercial filters were (and still are) expensive and home-made filters of these types using surplus crystals required considerable work in construction and adjustment.
The advent of the ladder filter has superseded other types for amateur receivers and transmitters. It is simple to construct and requires no adjustment.

Colour burst TV crystals on 3.579 MHz and 4.33 MHz and computer crystals are readily available. Three or four crystals are required for each filter with another two for use as upper and lower sideband in the BFO. There is now no reason to avoid the use of crystal filters in receivers and SSB transmitters built by home constructors.

MIXER AND OSCILLATOR TUNING

If only a small band of frequencies needs to be covered, the input tuning capacitor can be replaced by a suitable bandpass filter as in the G-QRP Club "Sudden" receiver. Iron powder toroids such as Amidon T-50-2 and T-50-6 are suitable for both mixer and oscillator circuits. If constructor preference is for slug tuned coils, these may be used provided good construction practice is observed.

CONSTRUCTION

Several methods of construction are available. The MC3357 can be mounted on a 16-pin PCB. Alternatively, dual 20-pin IC Boards (Tandy), which can be separated, have been satisfactory. The components are mounted on the copper side of the boards. The 3357 can be mounted on one board and the NE602 and LM386 on the other. If more space is desired, DSE Prototype Boards or Plug-in IC Boards could be considered.
Crystal filters can be mounted on a small piece of single-sided board, isolating pads being created with hacksaw cuts across the board. Crystals can be soldered direct to the board, using a heat sink when soldering the pins.
All the boards can be mounted at the bottom of a simple "U" chassis, the front panel taking the mixer tuning capacitor (if used), the main tuning (oscillator) capacitor, audio gain control, on-off switch and a LED indicator. On the rear panel can be mounted an RCA socket for antenna input and suitable power connectors.

POWER SUPPLY

Requirements are modest being 5 volts regulated for the NE602 and MC3357 and 6 to 9 volts for the LM386. Some versions of the 386 will accept 12 volts (LM386-N2. A 5 volt regulator should be used in preference to a zener, as the latter can be noisy in receivers.
(National Semiconductor data:
Operating Supply Voltage ranges are 4 - 12 V for LM386N-1 & LM386N-3 and 5 - 18 V for LM386N-4)
Step by step construction notes are not given, as assembly and soldering of components is straightforward. The results obtained from this simple design should provide the constructor with a receiver suitable for amateur and short-wave listener requirements.

REFERENCES

1. Receiver Notes, B Dale, MC3357 and MC3359 Experimenting.
2. The SIMPLEceiver, Bruce O. Williams, WA6IVC, QST September 1986.
3. 40 Meter Receiver, Garry Cratt, VK2YBX, Silicon Chip, Dec. 1989.
4. Simple SupeRX, Bruce O. Williams WA6IVC, 73 Amateur Radio April 1991.

The Following has been condensed from an article published in the September 1994 issue of QRPp The Journal of the Northern California QRP Club

THE EPIPHYTE : A SIMPLE QRP SSB TRANSCEIVER

Derry Spittle VE7QK,1241 Mt. Crown Rd. N.Vancouver, BC, Canada. V7R 1R9

Battery operated portable HF equipment still affords the only practical means of communication from wilderness areas beyond the range of VHF repeaters

THE OBJECTIVE

To construct a simple portable transceiver capable of providing effective voice communication with the nightly British Columbia Public Service Net on 3729 KHz from anywhere within the province. It should be:-

- of simple design and easy to replicate,
- inexpensive to construct from readily available parts,
- small and light enough to backpack,
- able to withstand rough usage,
- capable of operating from AA batteries of 1Ah gel-cells, and
- tuneable over a limited range to permit off-frequency contacts.

THE CIRCUIT

The circuit for the "Epiphyte" has evolved from WA3RNCs "Neophyte", A second NE602 mixer and a SSB filter were first added to create a superhet receiver. To generate SSB the oscillators were reversed a microphone and speech amplifier added together with a narrow bandpass filter to remove the image, and amplifier to provide some useful output and a low pass filter to attenuate harmonics. Some T/R switching is all that was requited to create a transceiver.

The speech amplifier is an LM741 and an electret microphone plugs directly onto the PCB.

Ceramic resonators (available from CIRKIT in the UK) are used in both oscillators and their outputs are switched with a MC14066. Fortunately, 4.19 MHz is a "standard" resonator frequency which allows tuning between 3720 and 3780khz.

The PA is a VN10KM operating in Class A.

A DPDT relay provides DC switching voltages to the MC14066 and other circuits. It also grounds the RF input to the receiver on transmit.

To simplify both soldering and etching the PCB is single-sided. Wide traces are used throughout.

Such simplicity in design has not been achieved without some compromises having been made. There are inevitably some spurious responses but these fall below the maximum levels established for QRP operation.

ASSEMBLY

Commence by soldering in the two wire jumpers located beneath the socket of U-4. Next, solder a short length of bare wire to the ground tab on the muRata filter case, fold the tab under and feed the wire through the PCB to the off-centre ground pad before mounting. Install the IC sockets after first removing or cutting off the unused contacts in the socket for K-1. Install the remainder of the components leaving the toroids and screened coils until last.

Regardless of the final packaging, it is recommended that a simple chassis, formed out of a small sheet of aluminium (Figure 1), be used for testing and alignment. While pads are provided for external connections it is still recommended that Molex type connectors be used to facilitate removal. The PCB is drilled to accommodate them.

Install the components on the panels (Figure 1), mount the PCB on the chassis with metal separators and complete the external connections. With the exception of the microphone, negative leads may be omitted. Couple LED-1 at the antenna lead with a twisted pair to a three or four turn link over an FB-43-2401 core. A switch (not shown may be placed in the B+ line.

TESTING & ALIGNMENT

Remove all ICs and jumpers leaving only the relay in place. Connect a 12-14V fused power supply. Include an "idiot diode" in the line if you like to play it safe.

Verify with a VTVM that both oscillators are functioning. adjust the LF oscillator to 452.5KHz. Install U-2, U-3, U-4 and U-5. There should be 100 - 300 mV RF at pins 6 of U-2 and U-3. Connect a resonant antenna such as a half-wave dipole or inverted-vee. Listen for a signal and peak L-10 to align the receiver. Install dummy load. Set the bias on Q-4 and Q-5 to 1.5V before attaching the meter. with the meter attached re-adjust the bias to give a standing current of 30mA in Q-4 and 10 mA in Q-5. Install U1 and the microphone. With modulation, the current in Q-5 should peak to around 100mA..

The preferred method for aligning the RF filter, optimising the foregoing settings, and checking performance is to use a calibrated oscilloscope, frequency counter, two-tone audio oscillator and spectrum analyser. While some of us have become quite adept at generating a 1200Hz tone with our vocal chords, talking t ourselves to evaluate speech quality and making adjustments with nothing more than a receiver S-meter, it is a practice to be frowned upon. Moreover, it soon leads to family members questioning our sanity.

CONCLUSION

The "Epiphyte" has never failed to maintain communication with the Public Serve Net from remote areas of British Columbia. Battery drain averages around 35mA on receive and 170mA on transmit. reports on the audio quality have been complimentary.

Nevertheless, there seems little point in limiting the output to 1W when camping close to a vehicle or when kayaking. Battery weight is much less of a problem. A 7ah gel-cell will comfortably handle a 5W amplifier and provide a week or more of normal operation between charges. A construction for such an amplifier has already been prepared.

ACKNOWLEDGEMENTS

Most of the circuitry has been adapted from designs found in SPRAT, RADCOM, ARRL SOLID STATE DESIGN and QST. Any claim to originality lies solely in the PCB layout. I thank all members of the QRP Club of British Columbia for continual offers of advice and uninhibited signal reports - neither of which has required solicitation when anything was amiss; Doug Hendricks, K16DS for inviting me to publish an article in QRPp, Eric Swartz, WA6HHQ, for re-drafting the circuit diagram and lab-testing the rig; and finally, the VANCOUVER SUN crossword puzzle editor and O.E.D. for EPIPHYTE, a plant growing on another [f, EPI + Gk. *phuton*]

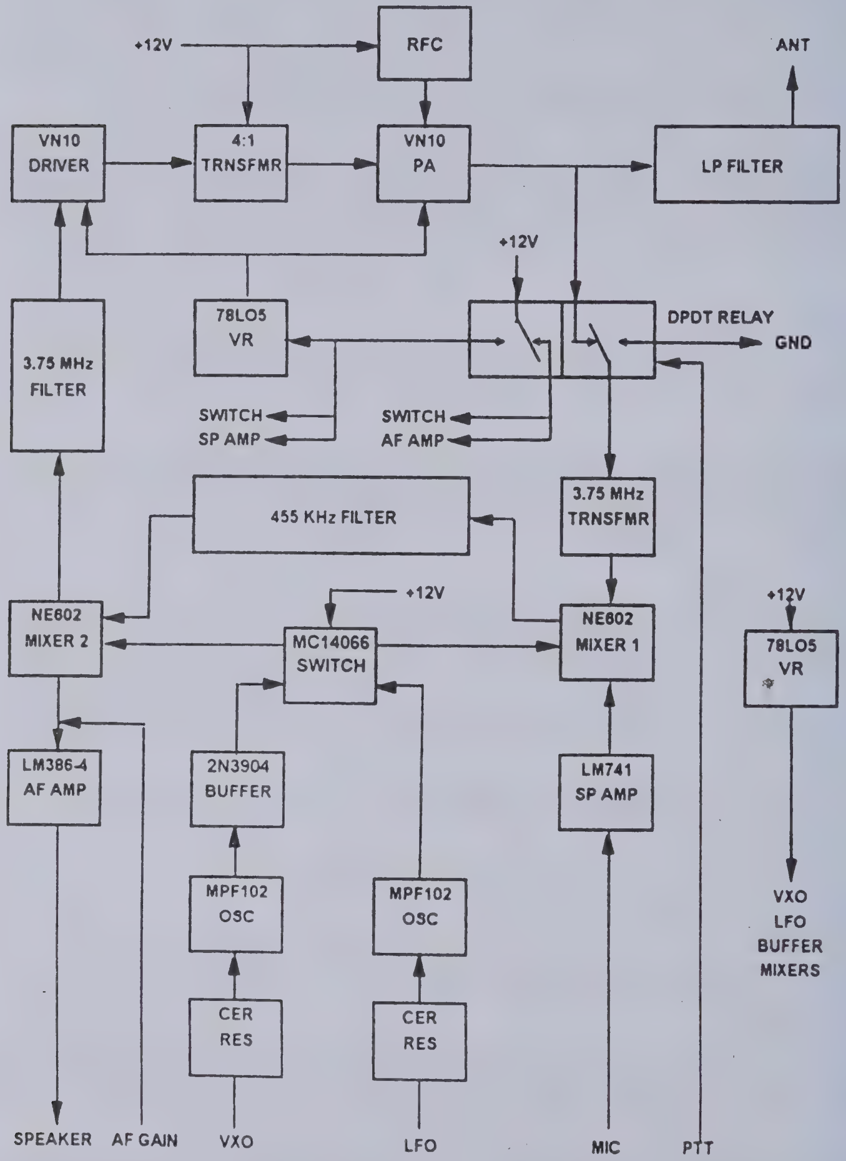
If you have questions or suggestions, please feel free to contact me at the above address or preferably via Internet. My .e-mail address is jds@freenet.vancounver.bc.ca

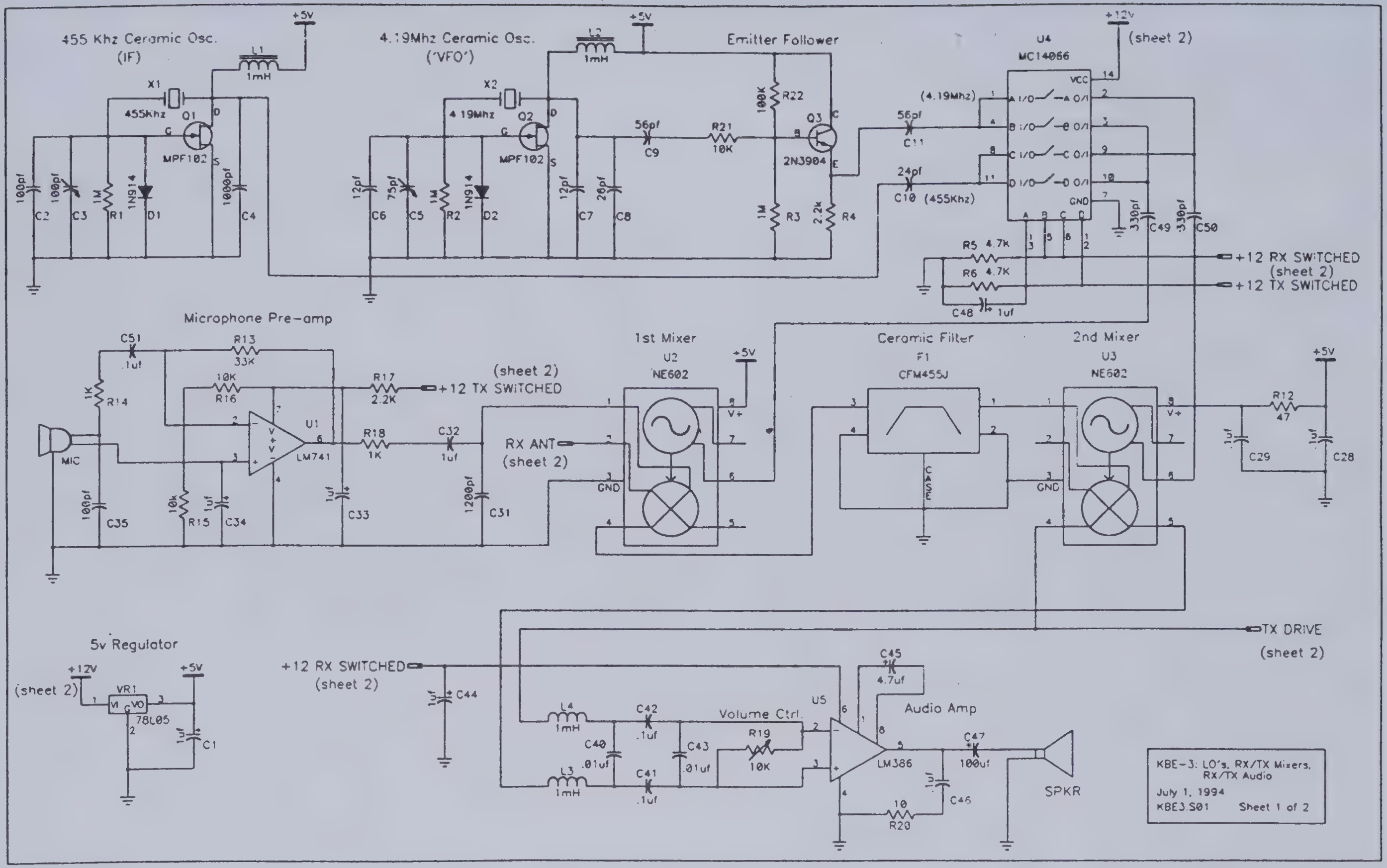
PRINTED CIRCUIT BOARDS FOR THE EPHIPHYTE
for £5.50 each including postage and packing
are available from:
HANDS ELECTRONICS, TEGRYN, LLANFYRNACH, DYFED. SA35 0BL.
KITS OF PARTS FOR THE EPHIPHYTE
are available from:
JAB ELECTRONIC COMPONENTS, The Industrial Estate, Rear of Queslett Motors, 1180 Aldridge Road, Great Barr, Birmingham, B44 8PB. Telephone 021-366-6928 for a price.

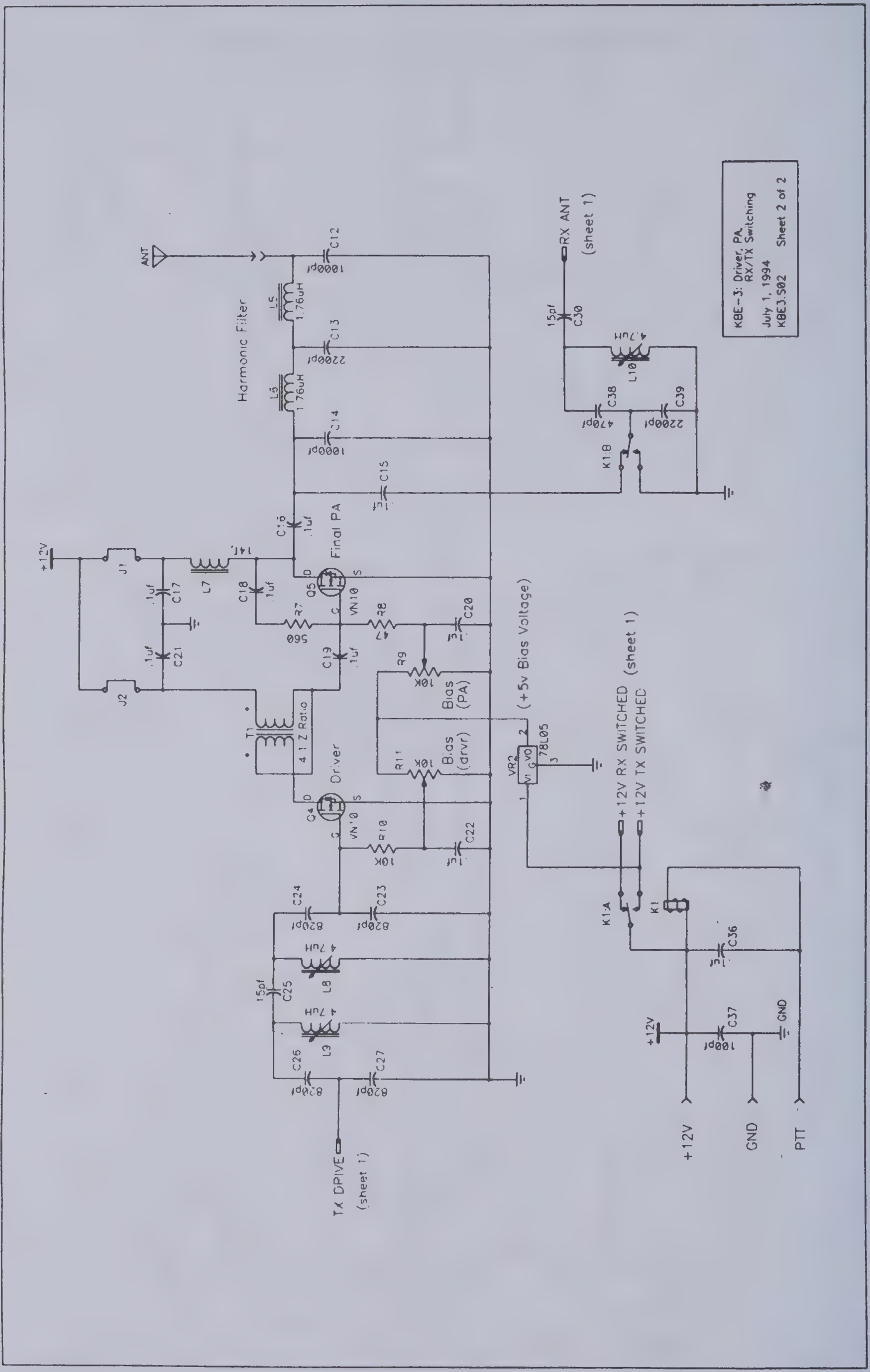
COMING IN THE NEXT ISSUE OF SPRAT

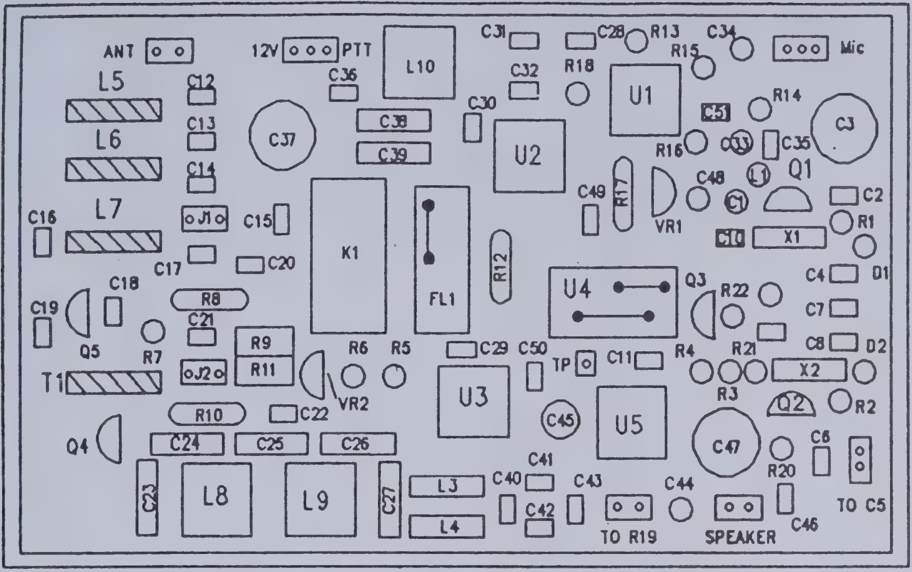
A FIVE WATT AMPLIFIER AND AND EXTERNAL VFO FOR THE EPHIPYTE

"EPIPHYTE" BLOCK DIAGRAM

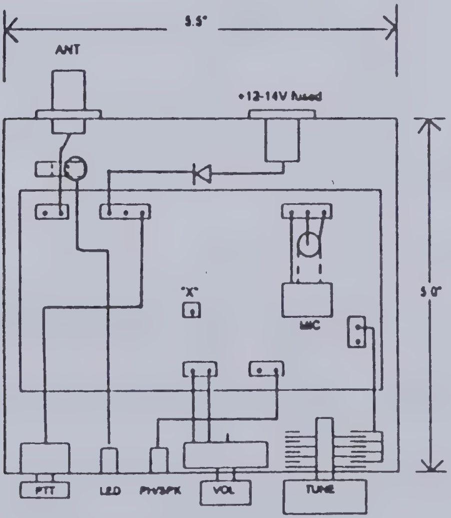



455 Khz Ceramic Osc. (IF)
X1 455Khz
Q1 MPF102
L1 1mH
+5V
C2 100pf
C3 100pf
R1 1M
D1 1N914
C4 1000pf
4.19Mhz Ceramic Osc. ('VFO')
X2 4.19Mhz
Q2 MPF102
L2 1mH
C6 12pf
C5 75pf
R2 1M
D2 1N914
C7 12pf
C8 28pf
C9 56pf
R21 10K
Emitter Follower
R22 100K
Q3 2N3904
R3 1M
R4 2.2K
U4 MC14066
+12V (sheet 2)
(4.19Mhz)
C11 56pf
C10 24pf (455Khz)
C49 330pf
C50 330pf
R5 4.7K
R6 4.7K
C48 1uf
+12 RX SWITCHED (sheet 2)
+12 TX SWITCHED
Microphone Pre-amp
C51 .1uf
R13 33K
R16 10K
R14 1K
MIC
C35 100pf
R15 10k
C34 1uf
U1 LM741
C33 1uf
R17 2.2K
+12 TX SWITCHED (sheet 2)
R18 1K
C32 1uf
C31 1200pf
RX ANT (sheet 2)
1st Mixer U2 NE602
+5V
Ceramic Filter F1 CFM455J
CASE
2nd Mixer U3 NE602
R12 47
C29 1uf
C28 1uf
TX DRIVE (sheet 2)
5v Regulator
+12V (sheet 2)
VR1 78L05
+5V
C1 1uf
+12 RX SWITCHED (sheet 2)
C44 1uf
L4 1mH
L3 1mH
C40 .01uf
C42 .1uf
C41 .1uf
C43 .01uf
Volume Ctrl.
R19 10K
U5 LM386
C45 4.7uf
Audio Amp
C47 100uf
C46 1uf
R20 10
SPKR
KBE-3: LO's, RX/TX Mixers, RX/TX Audio
July 1, 1994
KBE3.S01 Sheet 1 of 2


KBE-3: Driver, PA,
RX/TX Switching
July 1, 1994
KBE3.S02
Sheet 2 of 2
ANT
RX ANT
(sheet 1)
Harmonic Filter
L5 1.76uH
L6 1.76uH
C12 1000pf
C13 2200pf
C14 1000pf
C15 .1uf
C16 .1uf
Final PA
Q5 VN10
D
G
S
+12V
J1
J2
C17 .1uf
C21 .1uf
L7 14T
C18 .1uf
R7 560
R8 47
C20 .1uf
C19 .1uf
R9 10K
Bias (PA)
(+5v Bias Voltage)
T1
4:1 Z Ratio
Driver
Q4 VN10
R11 10K
Bias (drvr)
VR2 78L05
VI G VO
1 2 3
R10 10K
C22 .1uf
C24 820pf
C23 820pf
L8 4.7uH
C25 15pf
L9 4.7uH
C26 820pf
C27 820pf
TX DRIVE
(sheet 1)
+12V RX SWITCHED (sheet 1)
+12V TX SWITCHED
K1:A
K1
K1:B
C36 .1uf
C37 100pf
+12V
GND
C30 15pf
L10 4.7uH
C38 470pf
C39 2200pf
+12V
GND
PTT



EPHIPHYTE CHASSIS WIRING



EPHIPHYTE PARTS LAYOUT

"X" = connector for extrenal VFO and/or digital display
1.5" panels front and back
Twist wires to LED
Feed wires to PTT & LED under PCB

EPHIPHYTE PARTS LIST

CAPACITORS

C1	1mF	tantalum
C2	100pF	disc cer
C3	100pF	trimmer (10mm) (a)
C4	1000pF	disc cer
C5 (see CHASSIS & FIXTURES)		
C6,7	12pF	disc cer (NPO)
C8	26pF	disc cer (NPO)
C9	56pF	disc cer (NPO)
C10	24pF	disc cer (NPO)
C11	56pF	disc cer (NPO)
C12	1000pF	disc cer
C13	2200pF	disc cer
C14	1000pF	disc cer
C15 to 22	0.1mF	mon cer
C23, 24	820pF	polystyrene (axial) (b)
C25	15pF	disc cer (NPO)
C26, 27	820pF	polystyrene (axial) (b)
C28, 29	0.1mF	mon cer
C30	15pF	disc cer (NPO)
C31	1200pF	disc cer
C32	1mF	mon cer (c)
C33, 34	1mF	tantalum
C35	100pF	disc cer
C36	0.1mF	mon cer
C37	100mF	electrolytic
C38	470pF	polystyrene (axial) (b)
C39	2200pF	polystyrene (axial) (b)
C40	0.01mF	mon cer
C41, 42	0.1mF	mon cer
C43	0.01mF	mon cer
C44	1mF	tantalum
C45	4.7mF	electrolytic
C46	0.1mF	mon cer
C47	100mF	electrolytic
C48	1mF	tantalum
C49, 50	330pF	disc cer
C51	0.1mF	mon cer

Unless otherwise specified all capacitors are radial with 0.2" lead spacing. Monolithic caps may be used in place of the disc ceramics but are generally only available in packages. All 35V or better.

(a) A 60pF 10mm trimmer may be substituted here. The Philips 10mm trimmer caps have a different pin spacing but the PCB can be re-drilled to accomodate them.

(b) Available from Digi-Key.

(c) Non-polarized.

RESISTORS

R1, 2, 3	1M	
R4	2.2K	
R5, 6	4.7K	
R7	560	
R8	47	
R9	10K	vertical multi-turn trimmer (a)
R10	10K	
R11	10K	vertical multi-turn trimmer (a)
R12	47	
R13	33K	
R14	1K	
R15, 16	10K	
R17	2.2K	
R18	1K	
R19	(see CHASSIS & FIXTURES)	
R20	10	
R21	10K	
R22	100K	

All fixed resistors 1/4W

(a) Should be "in-line" pinout and "slim" profile in order to fit PCB

INDUCTORS

L1, 2, 3, 4	1000uH	miniature molded chokes
L5, 6	21 turns	Amidon T-37-2
L7	15 turns	Amidon FB-43-2401 (a)
L8, 8, 10	4.7uH	Toko 154ANS-T1005Z (b)
T1	7 bifilar turns	Amidon FB-43-2401 (a)

(a) These are described as "ferrite beads" but are in fact toroids

(b) These coils may be ordered from CIRKIT in UK along with the filter. DIGI-KEY lists them but the price is significantly higher.

CERAMICS

F1	455KHz	MuRata SSB filter (CFM455J1) (a)
X1	455KHz	ceramic resonator (a)
X2	4.19MHz	ceramic resonator (b)

(a) These filters seem to be available only from CIRKIT in UK. The 455KHz resonator and coils may be ordered from them at the same time. CIRCKIT catalogue prices include VAT (15%) which is not applicable to overseas orders. This helps offset the mailing cost.

(b) 4.19MHz resonators are available from RS Components in UK (the G-QRP Club has been most helpful in acquiring them for me and, I believe, presently has a small supply on hand). They are quite inexpensive. This is a "stndard" frequency and should be available in NA. Digi-Key carries surface-mounting 4.19KHz resonators only.

CHASSIS MOUNTINGS & EVERYTHING TO GET YOU ON THE AIR

C5 100pF air-spaced variable. Use a reduction drive (or reduce the value to c. 35pF with fixed capacitor(s) in parallel) for bandspread.
R19 10K (log) pot and knob.
BNC connectors (or RCA phono plug & socket).
Polarized (coax) power plug & socket.
Fused lead.
2.5"D 8ohm speaker and/or phones.
LED (antenna current) + Amidon FB-43-2401.
LED (power on) + 500 ohm res.
Chassis (aluminum sheet c. 5.5" x 7.5").
Stranded hook-up wire.
Enameled wire for toroids.
80M dipole & feeder.
12V power supply or battery.

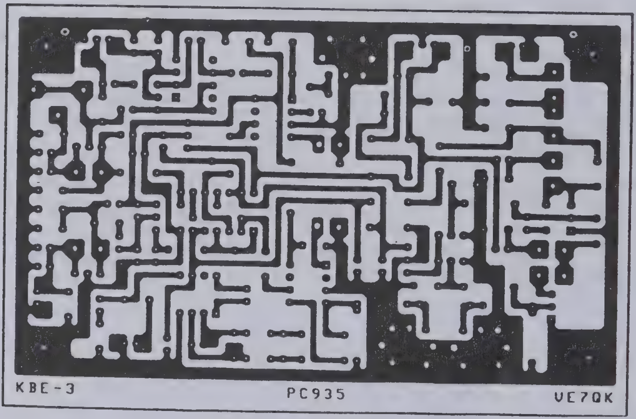
SEMIDUCTORS

D1, 2, 3	1N914	
Q1, 2	MPF102	
Q3	2N3904	
Q4, 5	VN10KM	
U1	LM741	
U2, 3	NE602	
U4	MC14066	
U5	LM386-4	(16V)
VR1, 2	78L05	

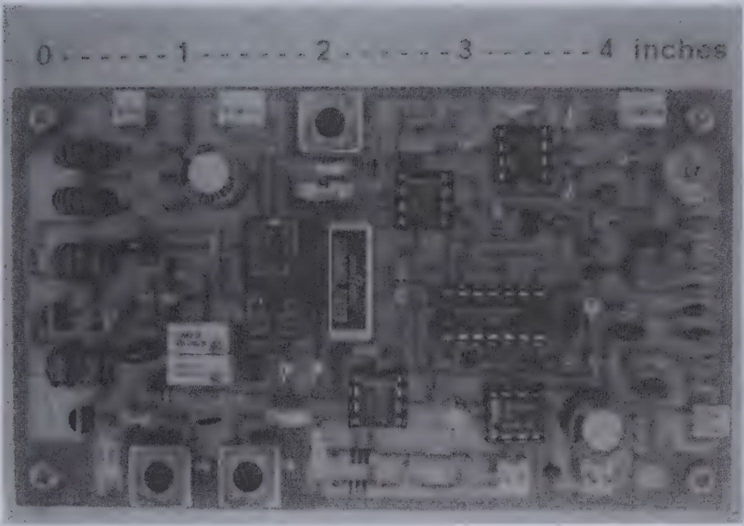
MISCELLANEOUS

K1	DPDT relay 12V. (Clare LX200D00 or equivalent)
MIC	Electret microphone (RS270-092. This has 3 leads)
J1, 2	Shorting jumpers & breakaway header (0.1" spacing)
1-4	Molex 0.1" polarized 2-circuit terminal housing, mating header & crimp terminals(a)
1,2	Molex 0.1" polarized 3-circuit terminal housing, mating header & crimp terminals(a)
1-4	0.25" 4-40 brass hex spacers & machine screws

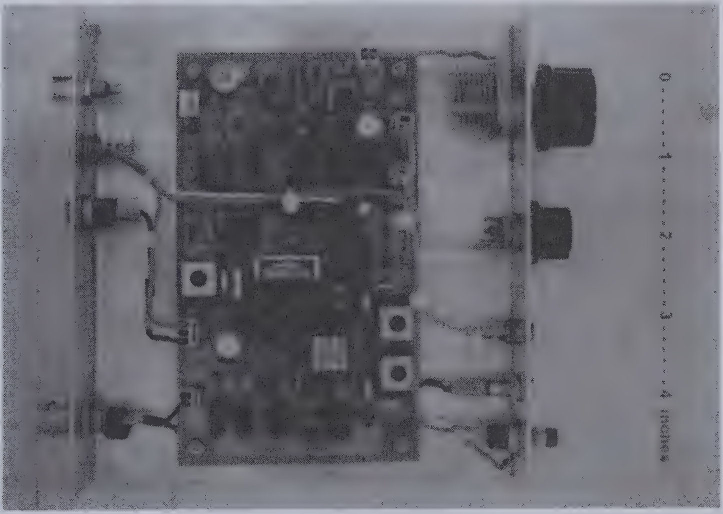
(a) Available from Mouser Electronics



EPIPHYTE PCB [Half Size]


0 - - - - - - 1 - - - - - - 2 - - - - - - 3 - - - - - - 4 inches

EPHIPHYTE BOARD LAYOUT


0 - - - - - - 1 - - - - - - 2 - - - - - - 3 - - - - - - 4 inches

BOARD MOUNTED WITH CONTROLS

The B.L.T. 20/17m SSB EXCITER Part 2

Byron C. Weaver WU2J. 430 Plant Ave.,NE, Palm Bay, Florida 32907

This project started out with several ideas and challenges in mind. The NE602 was to be used as a balanced modulator; the VXO and the Carrier Oscillator would be separated by only 455 KHz thru the use of small, inexpensive, no-fuss ceramic filters; simplicity and minimum parts count were to be an aim (words of the great Fred Sutter); and the 75 dB gain CA3020A (NTE 784) was to be pushed beyond its specified range to 20 and 17 meters.

Yes, I can hear the sceptics! Yet, I wanted to do something different for a change. My first QRP receiver was for 40m and that was almost 30 years ago. (The "Wee-Ceiver", CQ, Oct. 1967). The lower bands don't lend themselves to quiet SSB DX with G-QRPers. Antennas must be long and up high. Mobile antennas are not too efficient either. I often wondered why I never heard many European QRPers on 17 meters and those heard were running 100 watts. Finally, it dawned on me, may be they don't have a rig for 17m? That was my situation three years ago, until I built one. My opinion is 17m is a rare band that could be owned by QRPers!

My original exciter was finished in the Spring of '93 and it met all my goals with a power output of .75 watts. The carrier and spurious (include. VXO!) were down over 50 dB; quite respectable. To achieve these results a designer has to drive the NE602's (Pin 6) with not much more than the 200 mW minimum signal required. Separate oscillators permit controlling this level. Simplicity dictates NO IC SOCKETS in the TX or RX, otherwise the suppression will suffer. In my original unit, small walls from transformer cans were installed after the TX Mixer (IC3) to act as shields and prevent any leakage past the filter stages (T1 & T2). This is good practice and effective in this type of circuit. The shields were as high as the filter cans on the top side of the board and only one-quarter inch high on the bottom side. Their effect was very measurable. RG-174 is used for any signal leads.

The current PC board was designed especially for this SSB Exciter with the help of FAR Circuits. 'RJV ;thought with PC boards it'd make a nice Club "fun" project. FAR made an error in using 10mm transformer cans instead of the 7mm I used and prefer. The larger cans do make it easier for amateurs to adjust the turns. The larger cans do make it easier for amateurs to adjust the turns. You might think they are more 'robust' which ;is incorrect. First, unwinding a turn or two can have a marked difference in frequency change, i.e. you can't fine-trim them at higher frequencies. Their BW (for two) seems to be wider than the 7mm cans. Second, out of 10 I purchased, 4 were scrambled wound when the interior was examined. I had to rewind them! Guess a better employee is used on the 7mm cans as they're always perfect.

Since I've been using both transformer sizes for many projects the last few years, I've provided that additional information for amateurs interested in the higher frequency bands using these cans. (For bands lower than 30m, shunt capacitance is simply added). When adjusting the Receiver input transformers for 50 ohms (see SPRAT 80), it's useful to also measure the voltage on Pin 1 of the NE602 (via a diode detector and DVM. Voltage should be near maximum when the filters have been adjusted for minimum SWR at the centre receive frequency. Many times, I've rewound the transformer that feeds the '602 tapping off the primary winding and not using the small secondary. This way I could pick an impedance point near 1500 ohms the '602 is said to have as input impedance. Actually, I feel a high Z is better for the '602 because of its very small capacitance. I must say, however, little difference in results have been noticed so the simpler the better! Incidentally, the internal capacitor is 47 pf. and I prefer them inside the can.

RIT and a vernier dial I find unnecessary. An IF Noise Blanker may be added for mobile operation nit it's not needed on my own car. An amplifier will be added later.

The microphone circuit in SPRAT 80 (pg 35) is used with my TX by going directly to Pin 1 , IC1. It's recommended. Note that the PC board has been designed with holes for a conventional audio amplifier prior to the '602 to facilitate your mic design. My intent was to make these boards a general purpose as possible for many projects.

Adjustment for the Carrier Oscillator is by selection of C13 and/or C14. Adding capacitance in parallel with C13 will take the frequency down. There is a place for a trimmer capacitor between CR1 and ground although I haven't found it necessary. You can jumper the Carrier Oscillator via C11 directly to the input of CFL1 to get a CW output to align T1 & T2 roughly. Be careful to adjust to the correct and desired frequency. It's possible to get the VXO frequency, the sum and the difference frequencies with the 10mm cans. A frequency counter is ideal for tune-up and a second receiver the bare-minimum. I built the two-tone audio generator (QST, Nov.'93) which sure beats whistling! A good heat sink is required for IC6. I made my own from copper strips in a flange fashion. It was soldered directly to the top of the final via a small hole in the heat sink. (Not recommended)

Perhaps the best method of checking out a SSB Transceiver it to talk and listen to your XYL (using another Xcvr) with dummy loads connected to the antenna jacks and a short piece of wire on the hot-side of the load. Best results are achieved with equipment in different rooms and each of you changing positions a few times. (She'll love it, gives her a chance to talk to you once in a while!)

I've had very good success using just the exciter's low level power for communicating. Last year I had a 'pile-up' when I said I was running 125 mw SSB. One mobile 2000 miles away said I was louder than my QRP neighbour running 100W to a long wire. My research indicates creatively designed short verticals really excel on autos (17m & 20m). Maybe SPRAT would wish some new information on mobile antennas...tu veus? A two element yagi has been built for 17m with 4.5 dBd gain and its only 13 ft (4m) long ...ou to veus pas?

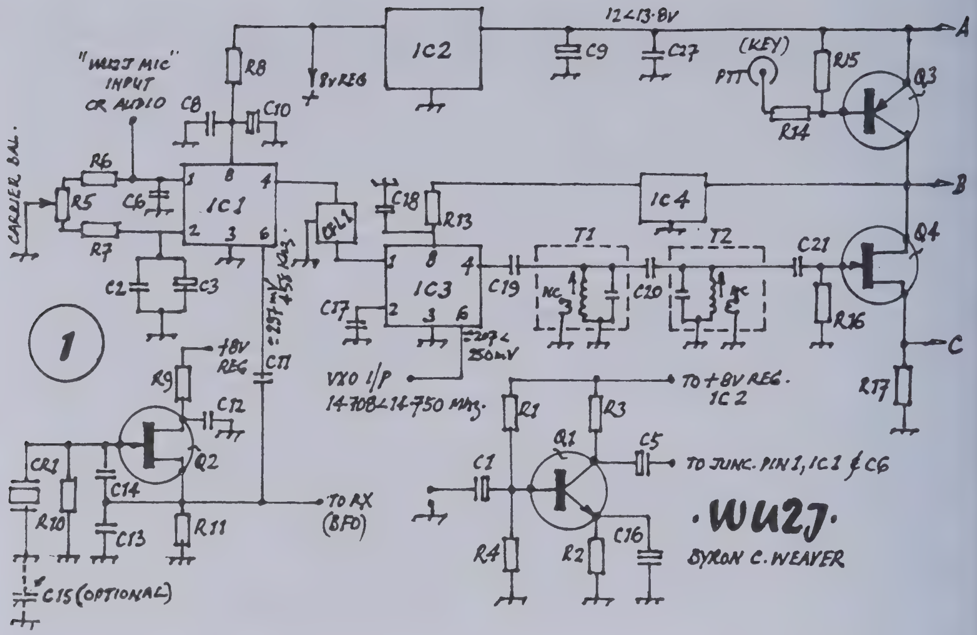
You may wish to design your own amplifier to boost the power, only one transistor is required with this power-packed exciter featuring excellent audio. Ah, I forgot to mention, the 17m Exciter delivers a third of a watt!! Incroyable, mais vrai! Similar receivers to the BLT RX have been used on this band for 3 years so the BLT is relatively simple to build. I'm looking into a source for cheap 17m crystals (18.627 MHz) for 'RJV. Practically the entire 17m SSB portion of the band is covered.

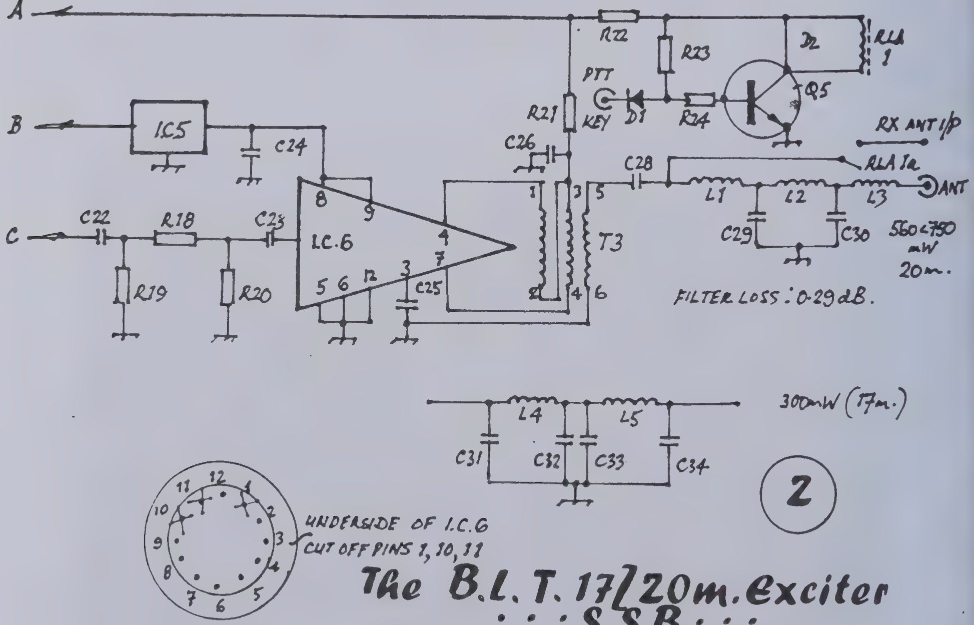
This article has been in various stages of print and production for over a year now as the Editor well knows. The ANV-20 in the last issue surprised me so you'll astutely observe my new emphasis on this also being a 17 meter SSB Xcvr! Probably the most surprised person will be 'RJV as I write this in. mid-October. Gotcha!

Hope to work you on SSB QRP one day... ...on 17m, of course.

---

* 62 dB if you do not consider the error of a 1N34 diode at 2-4 mv. (See W7EL's article, QST, Feb. 1990).





The B.L.T. 17/20m. Exciter

· · · SSB · · ·

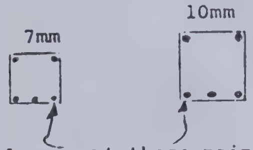
BLT SSB EXCITER : PARTS LIST

Audio Amp Parts: Your Choice, your ckt!
Q1, C1, C5, C16, R1, R2, R3, R4

R5 (mismarked R11)	1K pot(#271-280 Tandy) (Horiz. Micro-Size)
R6, R7,	68K
R8, R9	100R
R10, R16	100K
R12	omitted
R13,R19, R20	150R
R14	15K
R15	10K
R17	220R
R18	39R
R21	3R or 2.7R
R22	47R
R23	22K
R24	27K
R11	1K
D1	1N34
D2	1N914
RLA1	SPST Reed, 12VDC,11ma(Tandy) N.O. contact
Q2, Q4	MPF102
Q3	2N3906
Q5	BC108
IC1, IC3	NE602
IC2, IC4	78L08
IC5	78L09
IC6	NTE 784 (or CA3020A) Mouser
CFL1	CFU455IT MuRata Erie
CR1	455KHz Ceramic Resonator, Oak Hills Research; MuRata Erie
L1,L3	T37-6 12t
L2	T37-6 18t
T1, T2	7mm 10.7 MHz Xfmr, Mouser Part 42IF223 with 4 turns removed from top of bobbin (6 turns for 17 meters).
T1, T2	10mm 10.7 MHz Xfmr, Mouser Part 42IF123 with 4 turns removed from top of bobbin (6 turns for 17 meters).
T3	FT-37-61 11t trifilar, AWG30
L4,L5	T37-6 12t

C21, C22,C23, C26,	10n
C2,C6,C8, ,C17,C28, C27	10n
C3,C10	33u tantalum16V
C4	omitted
C7	omitted
C11	8p
C12	470n 16V
C13,C14	270 p poly
C15	Optional
C18,C24,C25	100n
C19	5 p
C20	1 p
C29, C30	270 p mica
C9	220 u 16V
C31, C32, C33, C34	180p

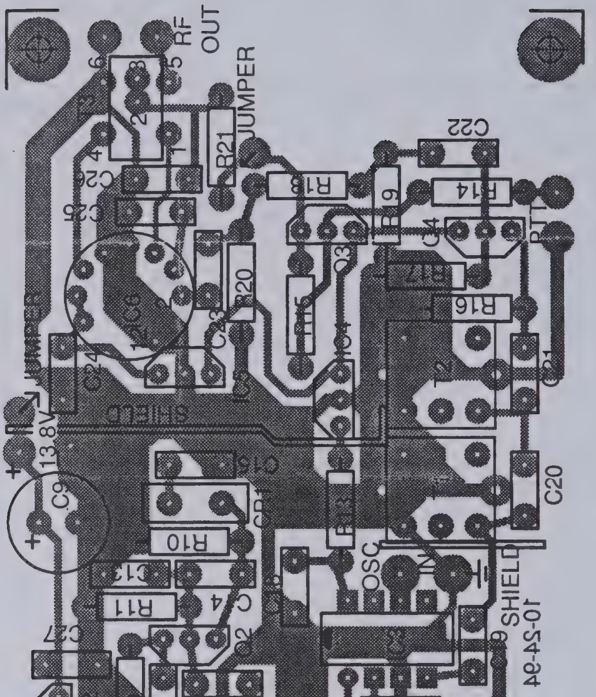
TRANSFORMER CANS
(Viewed from Bottom)



Loosen at these points to remove turns. A needle is helpful.

7mm Green Core
20m- remove 3 or 4 t
17m- remove 6t

15m- remove 8 t
10mm Green Core
20m- remove 4 turns
17m- remove 6 turns
15m- remove 7 t


WEAVER SSB EXCITER
by FAR CIRCUITS
10-24-94
RF OUT
JUMPER
AUDIO
13.8V
PTT
SHIELD
OSC
SSB
CW
R21
C26
C25
R18
R19
R14
C22
Q3
R17
R16
R20
C23
IC3
R15
IC4
C24
T2
C21
C15
C20
T1
C9
R13
R10
C13
R11
C14
Q2
C27
C12
R9
C10
C8
IC1
C3
C2
R7
R6
R5
C6
C5
R4
R2
Q1
C1
R1
R3
R8

The B.L.T. LINEAR AMPLIFIER

Byron C. Weaver WU2J. 430 Plant Ave.,NE, Palm Bay, Florida 32907

Rather than put off a Linear Amplifier for the BLT's until some time in the future, I thought I'd wrap up the project quickly for those of you that feel milliwatting is not your chief interest.

With the appropriate out put filter, this linear should work from 80-10m No feedback is employed so on the lower bands you should increase the emitter resistor and remove or reduce its bypass capacitor. On 20m you should be able to adjust these values to yield an output of around 8 watts. You could also add a 2 or 3 dB pad between the Exciter output and the linear's input capacitor.

The MRF 475 and the NTE 236 equivalent I find easy to work with in circuits using only one transistor. They can tolerate a good size VSWR without damage. Many transistors like the MRF749 and MRF630 have grounded emitters which prohibit the use of a small resistor in the emitter. The MRF630 put out about 4.5 W in the same circuit but that was pushing it. The MRF749 gave over 10 watts and ran nicely at 7-8 watts. But, it's expensive and you'll have to use a heftier (larger core and wire size) 5.6 to 50 ohm output transformer as the power approaches the 8-13 watt range. An emitter resistor prevents thermal runaway.

The manufacturer recommends a quiescent current (ICQ) of 20 ma. This is the collector current with not signal input. Some prefer ;this current in the 20-30 ma range but even at 15mA the products are tolerable for QRP operation. If the current doesn't return fairly quickly to your present value after driving the amplifier at full power for some time, it means your heat sink isn't as good as it could be. The ICQQ will return to normal as the transistor cools even if the heat sink isn't the best, it just takes a little time!

Conventional transformers can be used instead of transmission line transformers. You only have to adjust the turns ratio and use balun cores or 0.5 inch O.D. A transmission line transformer of this diameter has been tested at 27 watts by the author many times. That's the maximum power I have available. The core isn't the problem, it is the wire size. At the 27 watt level I was using AWG 22. Over 100 transformers have been built in recent years as I use them in all my antenna work. Although the schematic is the same, different techniques are employed in fabrication. I used FT-37-61 cores for the 17m transformers but if you're uncomfortable with such a small core you can use larger. Again, it's the wire size and its current capacity you have to worry about. The same size core was used for the Output Filter after the NTE 236 at the 5 watt level. The filter values were given on the Excited schematic and the loss was less than n 0.1 dB when tested at the 3 watt level in a filter-test set-up. This size has been used by me for several years up to 8 watts in a different Xcvr.

The amplifier is straight forward for many of you except n IC regulator is used to drop the voltage to 5 volts so the 100 lk ohm adjustment resistor can be 1/2 watt size. An insulator kit for the heat sink is available from Tandy. A good size heat sink is always preferred and the metal box wall ;is ideal. You might also wish to investigate the solid-state change-over used in the NORCAL 40 Xcver small fixed capacitor, and the Output Filer's first capacitor adjusted to account for the new shunt capacitance, you might prefer it to a relay It's certainly less expensive and smaller That's the way I like to see circuits.

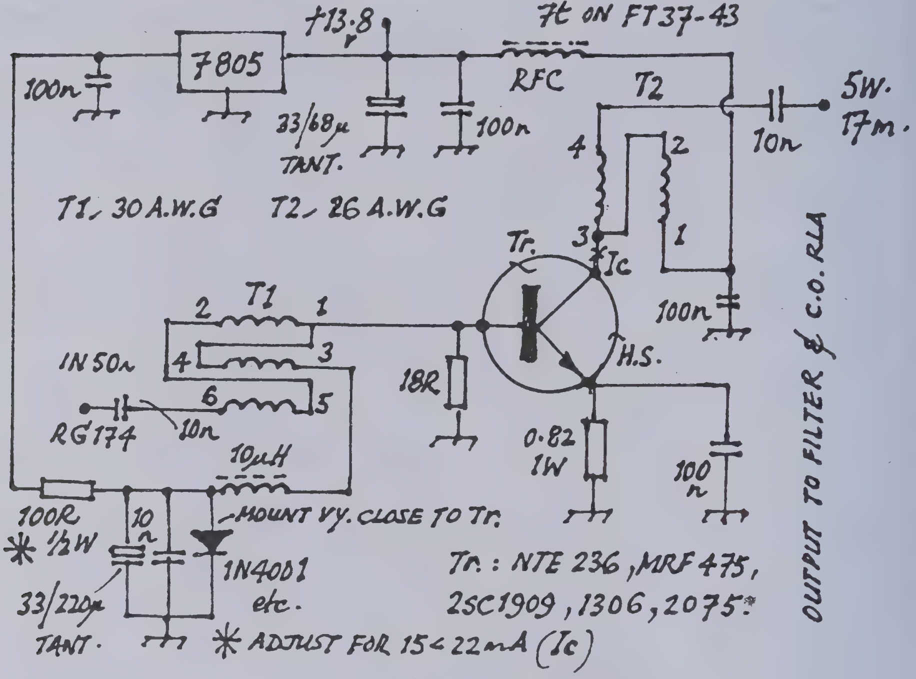
The Linear Amplifier was evaluated using the Mizuho MX-17S, an attenuate to reduce its power, and a SWR Bridge (low loss, non-resistive type) as a separate unit at first. It was then evaluated with the 330 mw drive from the Exciter through the SWR Bridge In ohm wattmeter, was 1.3:1 or less. Power output was just over 5 watts with the supply at 13.6 volts I should think FAR Circuits would be willing to make a small PC Board for this Linear if there is sufficient demand As I stated previously, 17 meters is the place to be for QRPers

You should not over look SPRAT 70 wherein G3XXQ presented his design for a linear to be used in the CSP project He used the 2SC1969 which is equivalent to the NTE 236, conventional transformers, and feedback Perhaps this transistor is less expensive

Sometimes I get the impression QRPers just feel they need to have a "little more" power when they operate SSB Some fiddled with a circuit to gain a half-watt to a watt more when their real problem rests with an poor antenna system Ask yourself, do you really need to operate on all bands? Are you "on the air" 24 hours a day? If you'd ever wish to have a "QRP Presence", you should consider an antenna dedicated to a band of your liking As 'RJV well knows, I hate ATU's and believe they destroy the meaning of antenna technology Even if you had an ATU and wire system that permits you to tune-up on

14 bands, you'd still never be able to work everybody. But, you could well display a weak and mucky SSB signal typical of what many say about QRPers. If you intend to work "over the pond" and farther on 17m you should learn to be less demanding of the other guy's antenna to pull you through. Start thinking like an "over the ponder" and concentrate on a dedicated antenna about which you know all the particulars! be a professional QRPer and we'll all have more respect and a consistent growth in membership.

Anyway, there you have it, "Byron's Last Transceiver" or "Bacon, Lettuce, and Tomato".....on a roll!



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A 5 WATT AMPLIFIER FOR THE EPIPHYTE

Derry Spittle VE7QK, 1241 Mt. Crown Rd. N.Vancouver, BC, Canada. V7R 1R9
e-mail : jds@freenet.vancouver.bc.ca

The Epiphyte, a simple QRP SSB Transceiver, appeared in SPRAT 81

The Epiphyte 80m SSB Transceiver was designed primarily to enable backpackers to communicate with the nightly BC Public Service Net. In this respect its performance has lived up to expectations. Still, in deference to those who wish to run a bit more power - which means just about everyone - here is a simple 5W amplifier which uses and inexpensive IRF510 Mosfet. It is designed as a "stand alone" unit which may (a) be left connected to switch in or out as desired, (b) be used with any other 80m transmitter in the 1W class, or (c) be left at home whenever you wish to remain "true to the cause"

During receive, K-1 by-passes the amplifier leaving the Epiphyte connected directly to the antenna. During transmit, the relay closes to connect the Epiphyte and the antenna to the amplifier RF input and output respectively. At the same time the PNP switch, Q2, applies B+ to VR1 to forward bias Q1
LED1 lights when the amplifier is on. LED2 lights when the Q1 is forward biased. LED3 lights with RF current to monitor the modulation. LED1 and LED2 may either be mounted on the panel or directly to the PCB. The Epiphyte PTT switch also controls the amplifier. D1 and D2 prevent DC from feeding back through a relay coil when either unit is switched off

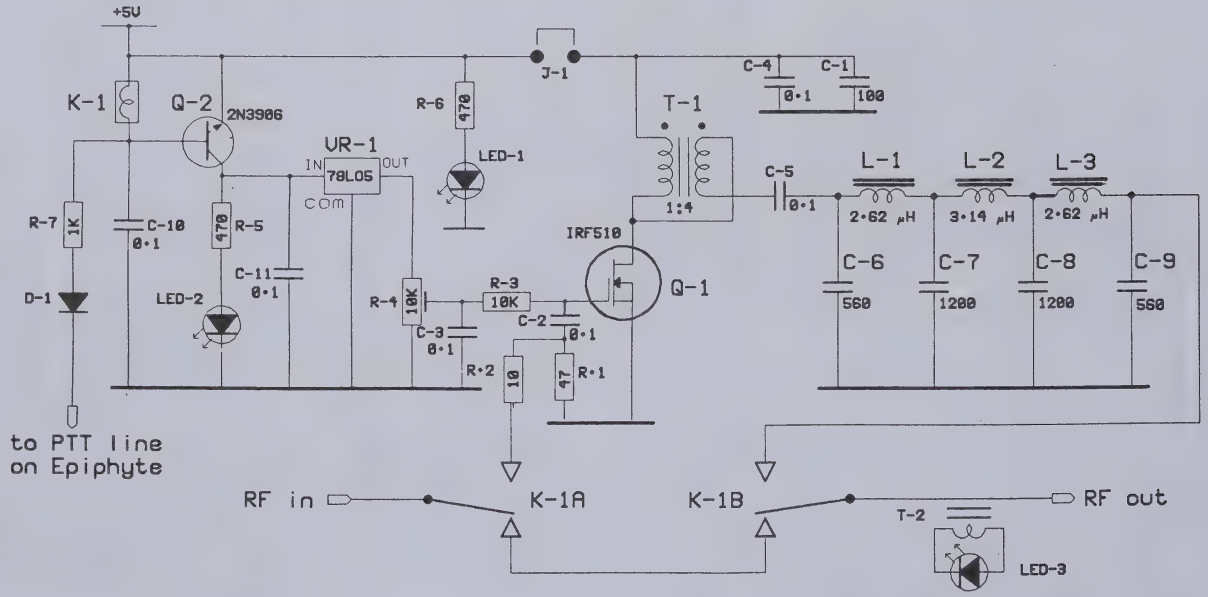
Before attempting to monitor the current in Q1, remove the shorting jumper and set the bias to around 2.5v with R4. Then with the meter installed, adjust the bias for an idling current of 20mA. The current will rise to 500 or 600mA with modulation. The amplifier board is drilled to accommodate Molex connectors if you so wish and, as in the Epiphyte, negative leads may be omitted if the PCB is securely mounted on a metal chassis. Once the components and the PCB are on hand it can easily be put together in a couple of evenings.

While the 7-element Chebyshev LP filter will further attenuate any out of band spurious responses it will do nothing to reduce IMD within the passband. The input signal must therefore be free from distortion. The amplifier output should be monitored with an oscilloscope to verify that it is not being overdriven. It requires about 0.5W drive to give an output of 5W A 2A power supply will comfortably handle the Epiphyte, amplifier and an LED digital readout .With normal usage, 1 7Ah gel-cell will provide a week or more of portable operation between charges

PARTS LIST

R-1	47	L-1 & 3	2.62µH (22 turns on T44-61 toroid)
R-2	10	L-2	3.14µH (25 turns on T44-61 toroid)
R-3	10K	Q-1	IRF 510 + heat sink
R-4	10K 10-t. pot.	Q-2	2N3906
R-7	1K	VR-1	78L05
R-5 & ,6	470	D-1 & 2	1N914
C-1	100µF electrolytic	LED-1, 2, 3	
C-2, 3, 4, 10	0.1µF	J-1	0.1" shorting jumper & header
C-6 & 9	560pF	Power plug , socket and fused lead	
C-7 & 8	1200pF	1 & 2	BNC connectors
T-1	1:4 step-up transformer (5 bifilar turns over a pair of FB 43-2401 beads)		
T-2	3 turns on FT37-61 toroid		
K-1	DPDT relay (Clare LM44D00 or equivalent)		
Chassis	Aluminium sheet c. 3.5" x 6". 1" panels along the short sides		
Molex connectors and terminal housings. 1 x 3-pin & 2 x 2-pin			
Heat sink on Q-1			

FIG 1 - 5W AMPLIFIER FOR THE EPIPHYTE

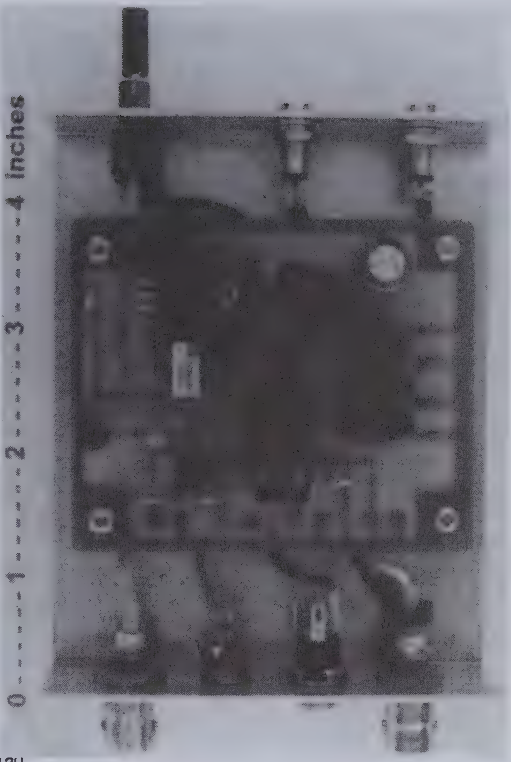


5 WATT AMPLIFIER FOR THE EPIPHYTE

Derry Spittle VE7QK

LAYOUT OF THE 5 WATT AMPLIFIER

PCBs : Hands Electronics
see advert this issue
Parts : JAB Electronics
0121 - 366 - 6928



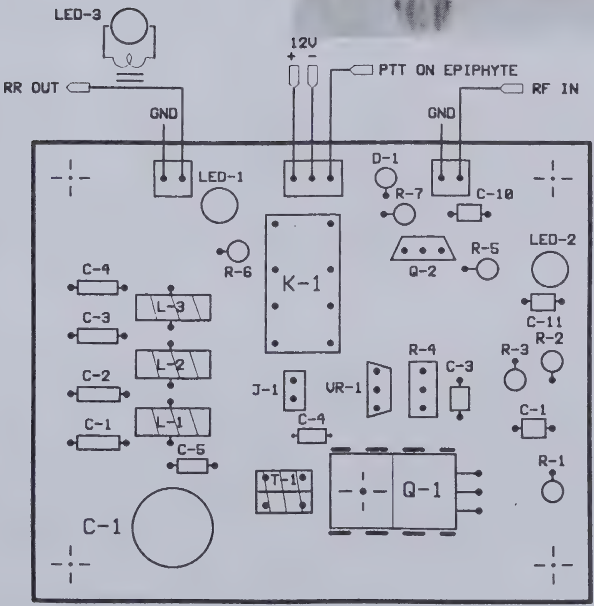


FIGURE 2 - COMPONENT LAYOUT

A DIGITAL DISPLAY FOR THE EPIPHYTE

Derry Spittle, VE7QK, 1241 Mt. Crown Rd, N. Vancouver, BC Canada V7R 1R9

The following has been adapted from an article in QRPp

SPRAT readers will be familiar with the **BASIC COUNTER** circuit (Fig. 1) which uses CD4026BE decade counter/7-segment decoders and requires no display latches or extra logic to generate the count-reset pulse. It has been around for a long time and in recent years John Hey, G3TDZ, had adapted it for use in his widely acclaimed phasing transceivers. The design I offer here operates from a five volt supply thereby eliminating the necessity for a current limiting resistor in each display segment. It also includes some simple logic to digitally effect a 453KHz offset. Although the counter has a LSD of 100Hz I have chosen to "prescale" the input signal with a high speed decade-divider so that the 4-digit display has a resolution of 1KHz. Here is a brief description for those who may be unfamiliar with its operation:-

The **50Hz CLOCK** (Fig.2) generates complementary (180 degrees out of phase) square waves from a 3.2768MHz crystal oscillator and divider with a modulus of 2^{16}. Circuit (a) uses a M706BI 50Hz timebase manufactured by SGS-Thomson. As this is now difficult to find, circuit (b) is an alternative employing readily semiductors.

TIMING (Fig.3). At 50Hz one complete "cycle" takes place in 20ms. Pulses are counted during the first 10ms. At the end of the "display period", the system is "reset" and cycle repeats. Positive reset pulses are generated very 20ms by differentiating the complementary output with C-1/R-1. D-1 "clamps" the negative pulses.

The **OFFSET LOGIC** assumes the VFO to be 453KHz higher than the signal frequency. The VFO frequency, reduced by a factor of 10, is fed to both U2a (NOR gate) and U3c (AND gate). If the number of pulses passing through U3c during each "count period" is reduced by 453 (453,000Hz x 0.1 x 0.01s) it will force the display to register the signal frequency. At the commencement of each cycle the out output of U-3b (pin 9) is LOW. U3c is closed and U-2a is open. Once the 4040 binary counter has received 453 pulses pin 9 of U-3b goes HIGH, U-2a closes (stopping further pulses reaching the 4040) and U-3c opens to pass to the 4026 display counters for the balance of the "count period").

This digital display has been in use for several years and some of you may have seen it at the 1992 QRP Mini-Convention in an earlier transceiver. It has now been installed, along with the Epiphyte, in a Ten-Tec 5" x 4" x 2" case. The 2" x 3.25" counter board is mounted in the top half of the enclosure along with the 4-digit display on brackets to place it behind the front panel. No PCBs are available at this time but something will be produced if there is sufficient interest. This unit is much quieter than programmable counters with multiplexed displays. Even without screening any hum from 50Hz leakage is well below band noise on 80M. ***Please let me know if anyone finds a source of M706BIs!***

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FIG. 1 - THE COUNTER

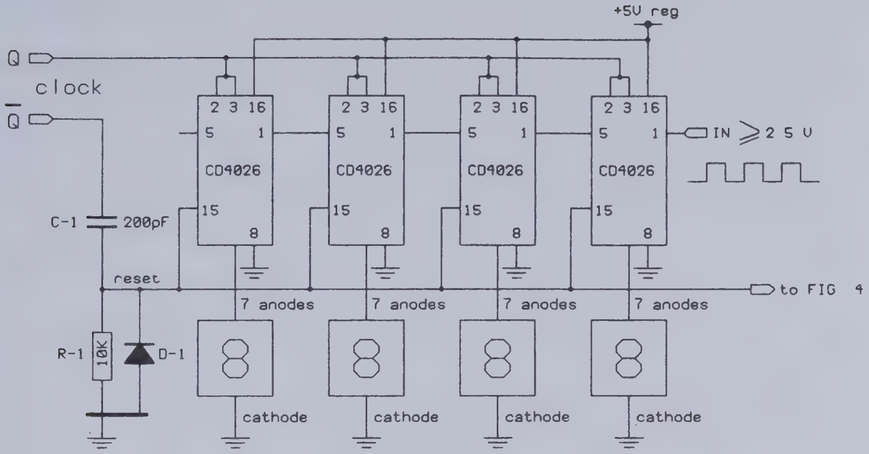
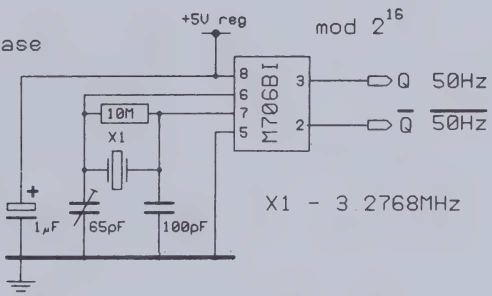


FIG 2 - THE CLOCK

(a) M706BI 50Hz timebase



(b) alternative circuit

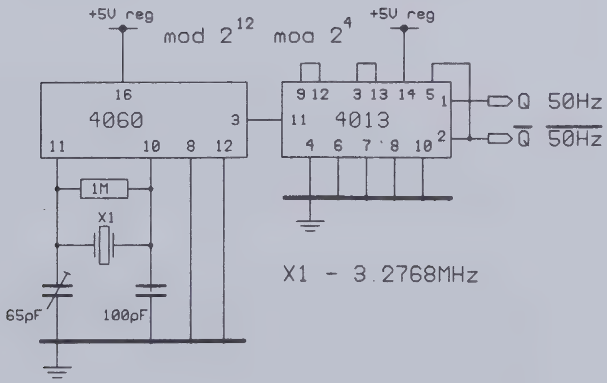


FIG 3 - TIMING

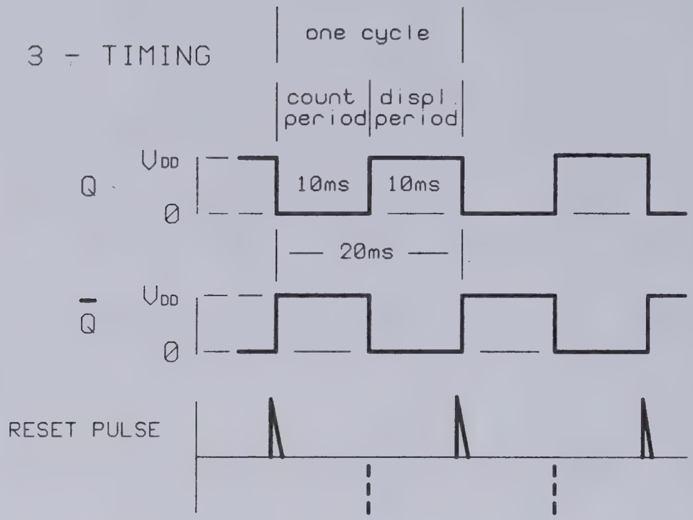
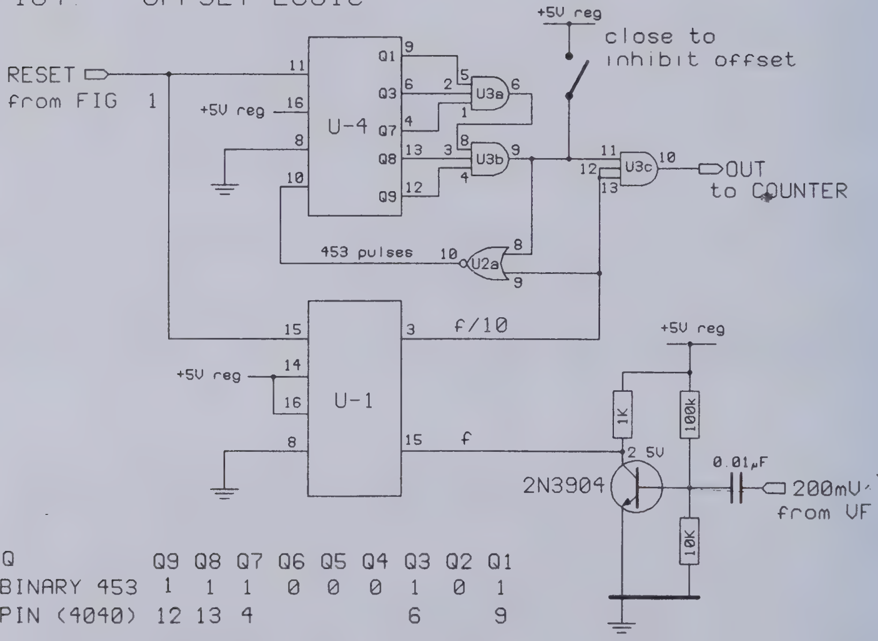


FIG4 - OFFSET LOGIC



Q	Q9	Q8	Q7	Q6	Q5	Q4	Q3	Q2	Q1
BINARY 453	1	1	1	0	0	0	1	0	1
PIN (4040)	12	13	4				6		9

U-1 74HC4017E DECADE COUNTER/DIVIDER
U-2 4001BPC quad 2-input NOR gate (3 sections unused)
U-3 4073BPC triple 3-input AND gate
U-4 4040BPC 12-bit BINARY COUNTER

A MORSE KEYER IN CMOS

Richard Hanes, G0RPH, 22 Lady Frances Dr. Market Rasen, Lincs. LN8 3JJ

A simple, low cost keyer with excellent timing characteristics, dot and dash storage, low power consumption, built-in sidetone and automatic powerdown. ***CLUB PCBs ARE AVAILABLE***

This circuit originated from a need for a keyer to try an experimental paddle arrangement. I wanted a circuit that was not too complicated but that would offer accurate timing of dots and dashes without the distortion of first element that is a feature of some of the simpler circuits. It is a development of one published in the RadCom Handbook and attributed to F3RUZ. The original met the basic requirements, and offered correct timing of spaces between dots and dashes as well, but was designed some years ago around TTL and was therefore not ideal for battery powering.

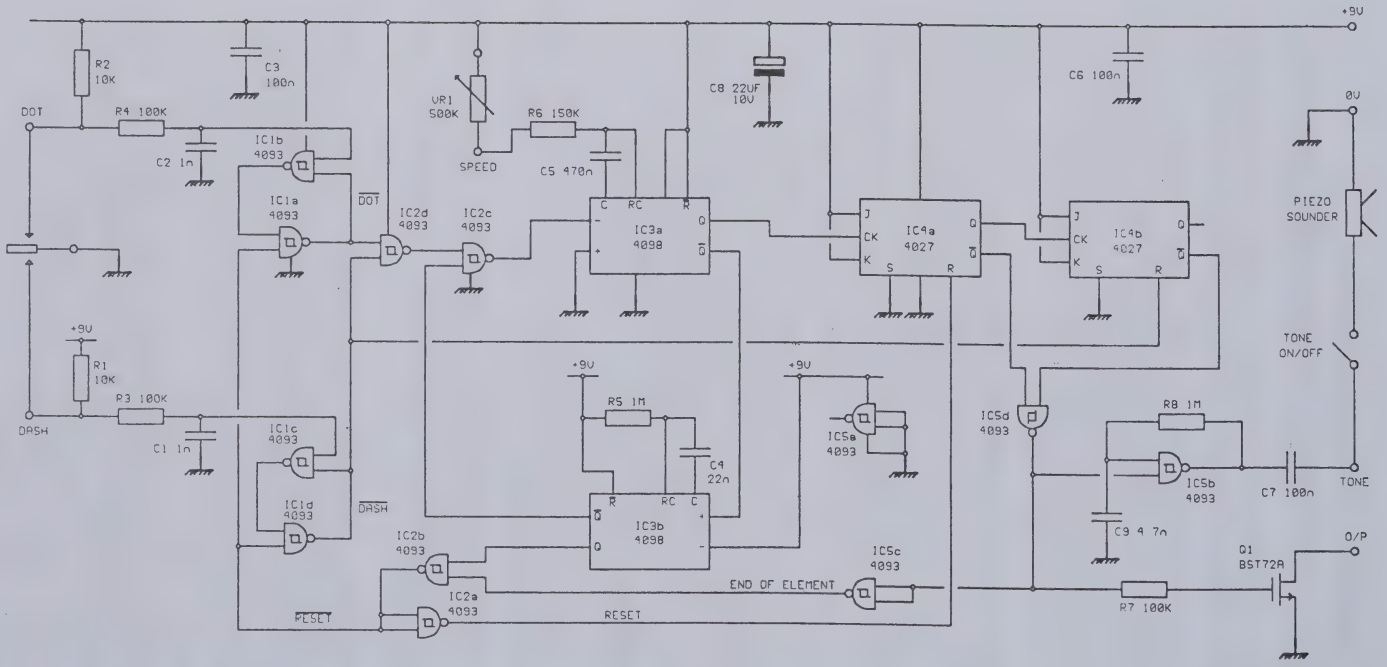
The development has comprised modifications to use CMOS ICs from the 4000 series which offer the advantages of much lower power consumption, low cost and tolerance of the changing voltage on the supply battery through its life. By careful design it has been possible to eliminate the need for an on/off switch. This is a major benefit at the RPH station where batteries regularly run flat when not watched! With typical sending the prototype draws a current of 1mA most of which is due to the key bias resistors. During receive or idle periods, the current is negligible. There is an internal sidetone generator and sounder but as this is designed using piezo effects it only contributes about 100uA of battery drain.

The circuit functions as follows; The incoming dot or dash is stored in the bistables formed by IC1. IC2c&d provide a trigger signal for the following monostable IC3a when a dot or a dash is requested by IC1. The time period of the monostable is controlled by C5 and VR1/R6 so that VR1 forms the speed control. With the values given a speed range of about 8 to 31 words per minute is obtained but the values can be adjusted if other ranges are required. At the time-out of IC3a, IC3b is triggered and provides a short reset pulse, inhibiting IC3a (via IC2c) from being retriggered during the reset period and also setting the conditions for retrigger immediately on completion of the reset period if the end-of-element (dot or dash as appropriate) signal has not reached IC2b. When the dash as appropriate) signal has not reached IC2b. When the end-of-element signal arrives, the IC1 bistables and IC4a are re reset and the circuit then awaits the next input from the paddle. IC3 completes a full cycle from the appearance of the end-of-element signal to the end of generation of the reset signal, this gives the correct spacing between elements.

IC4a and IC4b form a pair of binary counter stages that provide the dot (count 1) or the dash (count 3) division of the oscillator IC3a/b. The outputs of the counter are gated into a single signal element by IC5d and, if a dot is required, the counter is prevented from advancing to the count of 2 condition as the output of IC1d holds IC4b in the reset condition.

The output of IC5d is the required dot or dash and this is fed to the MOSFET Q1 used as the keying device. This MOSFET is adequate to key most rigs with a positive keying voltage. It will handle 50v and 200mA with ease. If your rig is relay-keyed internally then make sure that the relay has a parallel diode on its coil or the MOSFET will be destroyed by the back emf. A 47V zener between drain and source of Q1 (cathode to drain) would be a wise precaution if you are not sure. If your rig has a negative keying requirement then you could use a P-channel J-FET here but you will need to invert its drive using the spare gate of IC5,

IC5b forms a sidetone generator which is keyed by the dot or dash and drives the sounder. The values of RB and C9 may be adjusted to suit your tone preferences, however most of the piezo sounders are very inefficient at frequencies much below 1KHz.



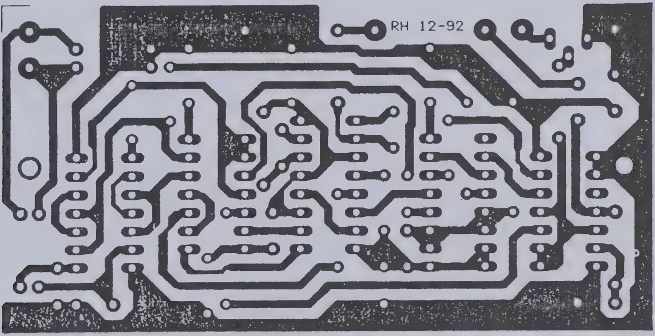
MORSE KEYER IN CMOS

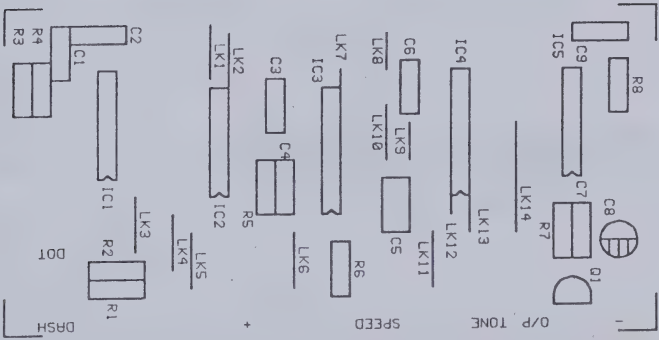
GORPH - 6967

The PCB layout is straightforward on single-sided board which is designed to fit in the Maplin box type PX-2. It will be necessary to file the corners off the PCB at one end in order to clear the screw pillars of this box it you wish to fit the battery in the same box, as I did. In order to obtain a single sided board there are a number of tinned copper wire links and some of these are under the integrated circuits. You will need to take care to fit these links before the ICs and to use a suitable fine wire (0.6mm fits OK). I don't use IC holders on my projects but if you prefer them, you will need to fit the links with sleeving on the back of the board, as most holders I have seen do not have clearance under them for the wire.

The power source is the ubiquitous PP3 type battery. I have found the alkaline type less prone to leakage (although not necessary from the current point of view). The extra cost is insurance against damaged components. The original has been in use for over two years, so I don't know how long it will last!

One final refinement worth considering (especially as it does not affect the PCB layout is the use of a 12-way switch with fixed resistors for VR1. There is room for this in the box specified, and it enables quick resetting to a favourite speed. The prototype has a calibrated scale which I find adequate.





CLUB PRINTED CIRCUIT BOARD OFFER

Printed Circuit Boards for this project are available to members for £3.00 plus 50p postage & packing (Cheques : G QRP CLUB) from: Ian Wye G0OKY, New House, Hook Road..
Amcotts, Nr. Scunthorpe. DN17 4AZ

A KIT OF PARTS is available from JAB ELECTRONIC COMPONENTS, Industrial Estate. Rear of 1180 Aldridge Road, Great Barr, Birmingham. B44 8PB. Tel : 0121 - 366 - 6928

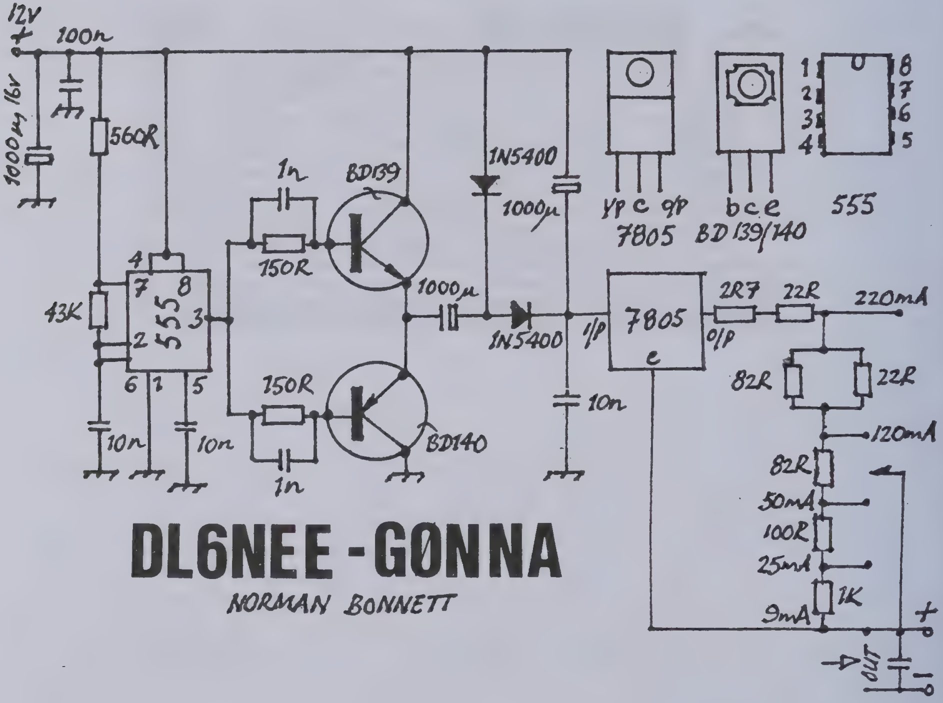
A NICAD CHARGER FROM THE CAR BATTERY

Norman Bonnett, DL6NEE (G0NNA) Weidleinsweg 14, 97222, RIMPAR, Germany

A small portable 2m rig such as the FT290R is a "must" when you go hiking or walking in remote areas. I am always amazed how accessible the Harrogate repeater is from the Yorkshire Dales and the Zugspitze repeater from most of southern Germany. You never know when you may need help!

12V Nicad packs don't charge well from a cigarette lighter socket in a car. Hence this simple charger. It originated in the Bradudderfax area of Yorkshire, for those not familiar with northern Britain this is a wild untamed area bounded by Bradford, Huddersfield and Halifax. During the removal to Germany the circuit got itself lost and so I developed it again.

No components are critical, you don't need a matched NPN/PNP pair of transistors. The 555 oscillates at about 1.5 kHz, the output is amplified by a complimentary pair, voltage doubled and rectified and passed through the ubiquitous 7805 to control the current. The BD139/140 need to case mounted via mica washers. It should be "worked first time" circuit.



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THE EP-2 PORTABLE 75M SSB TRANSCEIVER

Derry Spittle, VE7QK, 1241 Mt. Crown Rd., N. Vancouver, BC, V7R 1R9, Canada e-mail: jds@freenet,vancouver.bc.ca

Construction articles for the original Epiphyte[1] were published in the Fall of 1994 and further articles for a 5W amplifier and VFO[2] appeared shortly thereafter. The Epiphyte-2 includes both these features without increasing the size and without compromising the original objectives of simplicity and minimum power consumption

THE DRIVER STAGE is a CA3020A differential amplifier (U5) and replaces the original pair of VN10s to make room for a power amplifier. Operating from a 9V supply this stage has a power gain of 60dB, an idling dissipation of 200mW and an output of 500mW. It is matched to a 47 ohm resistive load (R23) at the gate of the final amplifier with a trifilar wound 4:1 broad band transformer (T1).

THE POWER AMPLIFIER (Q4) is an IRF510 Mosfet with an RF output of 5W PEP. An LCC circuit with Q of 10 matches this to a 50 ohm load. The low resistive input at the gate ensures unconditional stability. A low pass filter may be inserted in the antenna feeder.

THE VFO is a varactor tuned Vackar circuit and replaces the 4.19MHz ceramic resonator (VXO). The inductor is a Toko 3.3uH variable coil.

THE RF BANDPASS FILTER uses the same Toko 4.7uH coils but has been re-modelled in a series-tuned configuration using W7ZOI's GPLA program. It has a reasonably flat response over some 200kHz and sharper roll-off on the high frequency side to improve rejection of the image frequency. It has an input impedance of 1500 ohms to match the NE602 mixer and terminates in a 100 ohm resistive load to ensure stability in the driver. Fixed capacitors are "standard" values.

THE MICROPHONE input is a 2-pin Molex connector (con6). R19 provides the polarizing voltage for an electret microphone (2-terminal type) and should be omitted if a dynamic microphone is used. The value of R20 should match the impedance of the microphone. The speech amplifier (U6) gain may be adjusted by changing the value of R17.

ASSEMBLY is fairly straightforward but here are a few suggestions:-

Some fairly large value polystyrene capacitors are specified. Their physical size should be ascertained before ordering if they are to fit comfortably on the board. Ensure that the Toko coils (L3, 5, 6 & 8), filter (F1), ceramic resonator (X1) and trimmer cap (C10) fit the PCB; enlarge the holes if necessary. Install the CA3020A (U5) first; it is easier to align the twelve pins without other components in place. Be sure to solder in the two jumper wires before installing the socket for U1. Remove the center pin before mounting the IRF510 (Q4) and heat sink with a 4-40 machine screw, nut and star washers. Remove unused terminals from the relay socket. Finally, don't bother soldering the three unconnected pins on the Toko coils to the ground plane; you may need to remove the coils one day!

ALIGNMENT AND TESTING must be carried out with the single-sided PCB fastened to a ground plane with four metal stand-offs.

1. **REMOVE BOTH METERING JUMPERS.** Install the Relay (K1) and PTT switch if not built into the microphone. With all ICs removed connect to a 12-14V **FUSED** supply. Verify that VR2 is delivering 5V and that VR1 is delivering 9V on transmit. With an RF probe check that both oscillators are functioning.

2. Set the LFO to 453khz with the trimmer (C10). Change the padder (C11) if necessary.

3. Adjust L3 and R24 to set the tuning range. Bandspread, with the 10-turn potentiometer (R25), should not exceed 20KHz/turn or tuning will be too critical. Shorten the slug in L3 so that it sits flush with the top of the can and fix with beeswax or sliver from a rubber band.

4. Install all ICs. Connect the antenna, speaker, volume control. Test the receiver and adjust L8.

5. The RF voltage at pin 6 on each of the two mixers should read 140mV +/- 25%. If necessary, change the value of C5 and/or C6.

6. Set the RF drive control (R15) to minimum. Measure the transmit standing current in the driver (U5) at con7. If this is not 25mA +/- 10% the trifilar wound transformer (T1) or the driver (U5) has probably been incorrectly installed.

7. Adjust R3 to set the transmit idling current in the power amplifier (Q4) to 10mA at con8. **ONLY AT THIS POINT MAY BOTH METERING JUMPERS BE INSTALLED.**

8. Advance the RF drive (R15) and until RF voltage appears across a 50 ohm dummy load while modulating with a tone (whistle!). Adjust the bandpass filter (L5 & L6) to maximize. Continue increasing the drive until it peaks to around 16 volts. The driver current should rise to 60 or 70mA and drop to around 25mA with no modulation. The IRF510 current should rise to 300 or 400mA and drop to around 10mA with no modulation. Monitor the signal on a receiver and/or oscilloscope. The "average" current with normal speech modulation will, of course, be considerably less. This completes the alignment.

The 2.9" x 4.75" PCB and a digital display fit comfortably into a 5" x 4" x 2" TenTec enclosure (Model TP-20). The Molex type connectors permit a great deal of flexibility in packaging.

Have fun. Feedback is always welcome. 72 Derry VE7QK

---

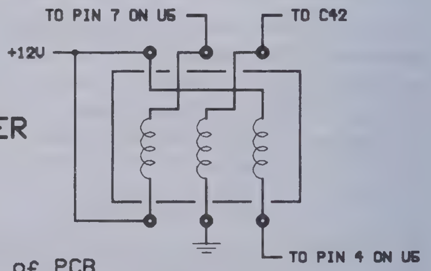
[1] QRPp Sep 1994 pp. 29-38. SPRAT 81 (Winter 1994/5) pp. 3-12.
[2] QRPp Dec 1994 pp. 44-52. QRPp Mar 1995 p. 66. SPRAT 82 (Spring 1995).

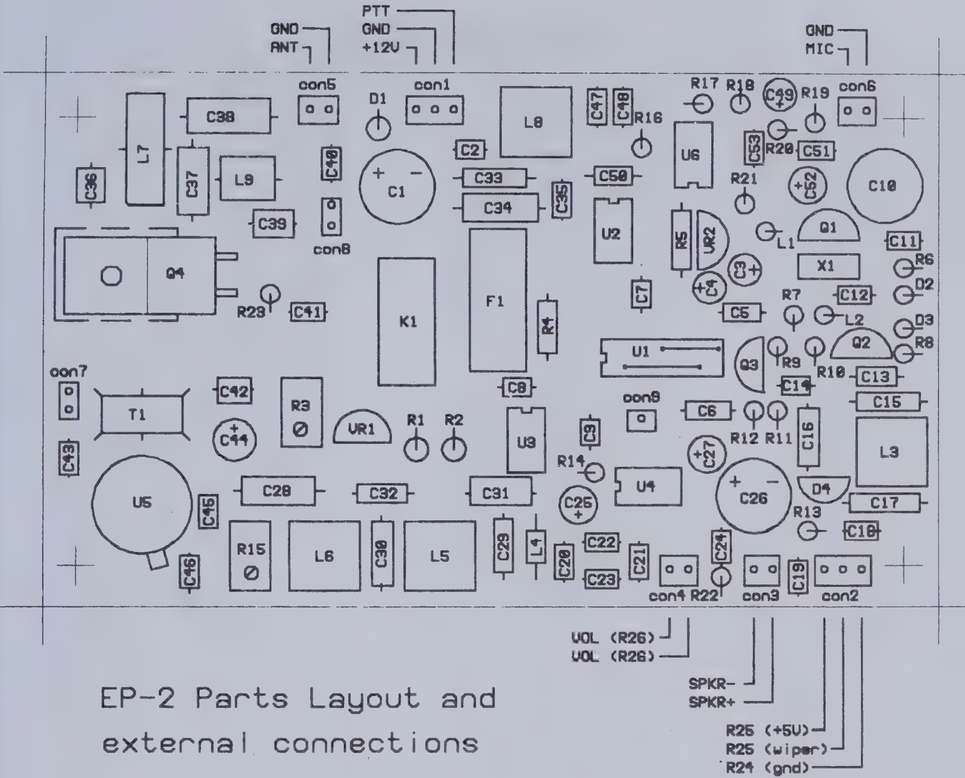
EP-2

T1 BROAD BAND TRANSFORMER

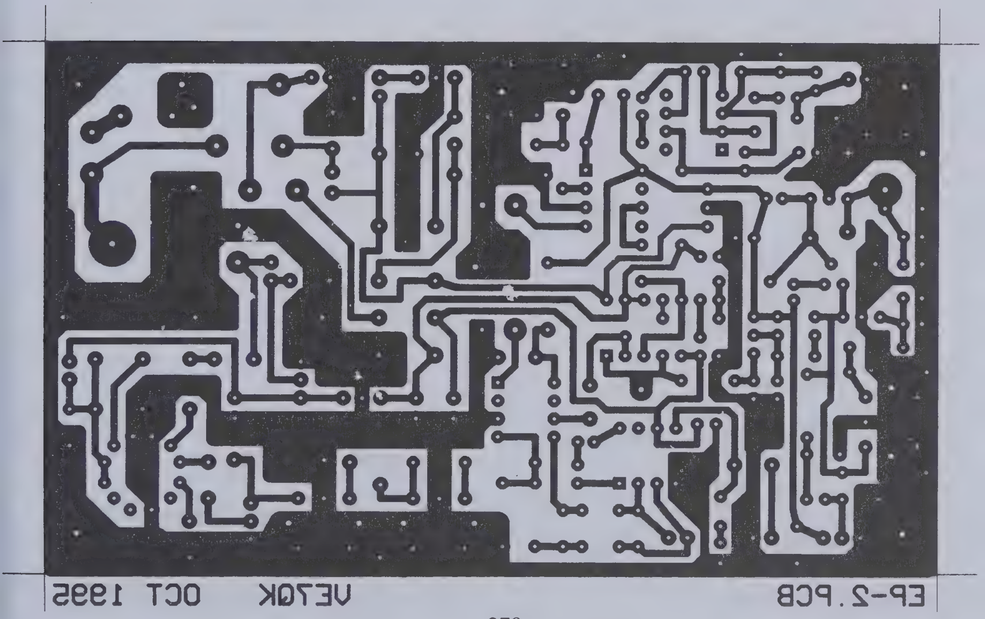
Details of trifilar winding

Connections as viewed from top of PCB




PTT
GND
+12V
GND
ANT
GND
MIC
con1
con2
con3
con4
con5
con6
con7
con8
con9
VOL (R26)
VOL (R26)
SPKR-
SPKR+
R25 (+5V)
R25 (wiper)
R24 (gnd)
C1 C2 C3 C4 C5 C6 C7 C8 C9 C10 C11 C12 C13 C14 C15 C16 C17 C18 C19 C20 C21 C22 C23 C24 C25 C26 C27 C28 C29 C30 C31 C32 C33 C34 C35 C36 C37 C38 C39 C40 C41 C42 C43 C44 C45 C46 C47 C48 C49 C50 C51 C52 C53
R1 R2 R3 R4 R5 R6 R7 R8 R9 R10 R11 R12 R13 R14 R15 R16 R17 R18 R19 R20 R21 R22 R23
L1 L2 L3 L4 L5 L6 L7 L8 L9
U1 U2 U3 U4 U5 U6
Q1 Q2 Q3 Q4
D1 D2 D3 D4
VR1 VR2
K1 F1 T1 X1

EP-2 Parts Layout and external connections



EP-2 PARTS LIST

C1 100 mF (elec)
C2 0.1 mF (mon cer)
C3 1 mF (tant)
C4 1 mF (tant)
C5 24 pF (NPO)
C6 24 pF (NPO)
C7 330 pF (disc cer)
C8 0.1 mF (mon cer)
C9 330 pF (disc cer)
C10 100 pF (trimmer)
C11 50 pF (NPO}
C12 1200 pF (cer)
C13 100 pF (NPO)
C14 24 pF (NPO)
C15 2200 pf (ax poly)
C16 820 pF (ax poly)
C17 1000 pF (ax poly)
C18 0.1 mF (mon cer)
C19 0.1 mF (mon cer)
C20 0.01 mF (mon cer)
C21 0.01 mF (mon cer)
C22 0.1 mF (mon cer)
C23 0.1 mf (mon cer)
C24 0.1 mF (mon cer)
C25 4.7 mF (elec)
C26 100 mF (elec)
C27 10 mF (tant)
C28 2200 pf (ax poly)
C29 470 pF (ax poly)
C30 5600 pF (ax poly)
C31 2200 pF (ax poly)
C32 470 pF (NPO)
C33 470 pF (ax poly)

C34 2200 pF (ax poly)
C35 15 pF (NPO)
C36 0.1 mF (mon cer)
C37 150 pF (ax poly)
C38 150 pF (ax poly)
C39 0.1 mF (mon cer)
C40 0.1 mF (mon cer)
C41 0.1 mF (mon cer)
C42 0.1 mF (mon cer)
C43 0.1 mF (mon cer)
C44 1 mF (tant)
C45 0.01 mF(mon cer)
C46 0.01 mF(mon cer)
C47 1200 mF(disc cer)
C48 0.1 mF (mon cer)
C49 1 mF (tant)
C50 1 mF (non-polar cer)
C51 150 pF (disc cer)
C52 1 mF (tant)
C53 1mF (non-polar cer)

R1 4.7K
R2 4.7K
R3 10K (10t. trim pot)
R4 47
R5 2.2K
R6 1 M
R7 100
R8 100K
R9 22K
R10 10K
R11 22K
R12 2.2K

R13 10K
R14 100
R15 100 (10t trim pot)
R16 1K
R17 33K
R18 10K
R19 4.7K
R20 400
R21 10K
R22 10
R23 47
R24 4.7K
R25 10K (prec 10t. pot)
R26 20K (vol. control)

VR1 78LO9
VR2 78L05

U1 MC14066
U2 NE602A
U3 NE602A
U4 LM386-4
U5 CA3020A
U6 MC1741

Q1 MPF102
Q2 MPF102
Q3 2N3904
Q4 IRF510

L1 1 mH choke
L2 1 mH choke

L3 3.3 uH var coil (Toko BTKANS9445)
L4 1 mH choke
L5 4.7 uH var coil (Toko 154AN-T1005)
L6 4.7 uH var coil (Toko 154AN-T1005)
L7 6uH (33t on Amidon T50-2 toroid)
L8 4.7 uH var coil (Toko 154AN-T1005)
L9 RFC (7t on Amidon FB43-801)

T1 4:1 broadband transformer (5 trifilar t. on Amidon FB-43-2401)
T2 2 t. on Amidon FB-43-2401

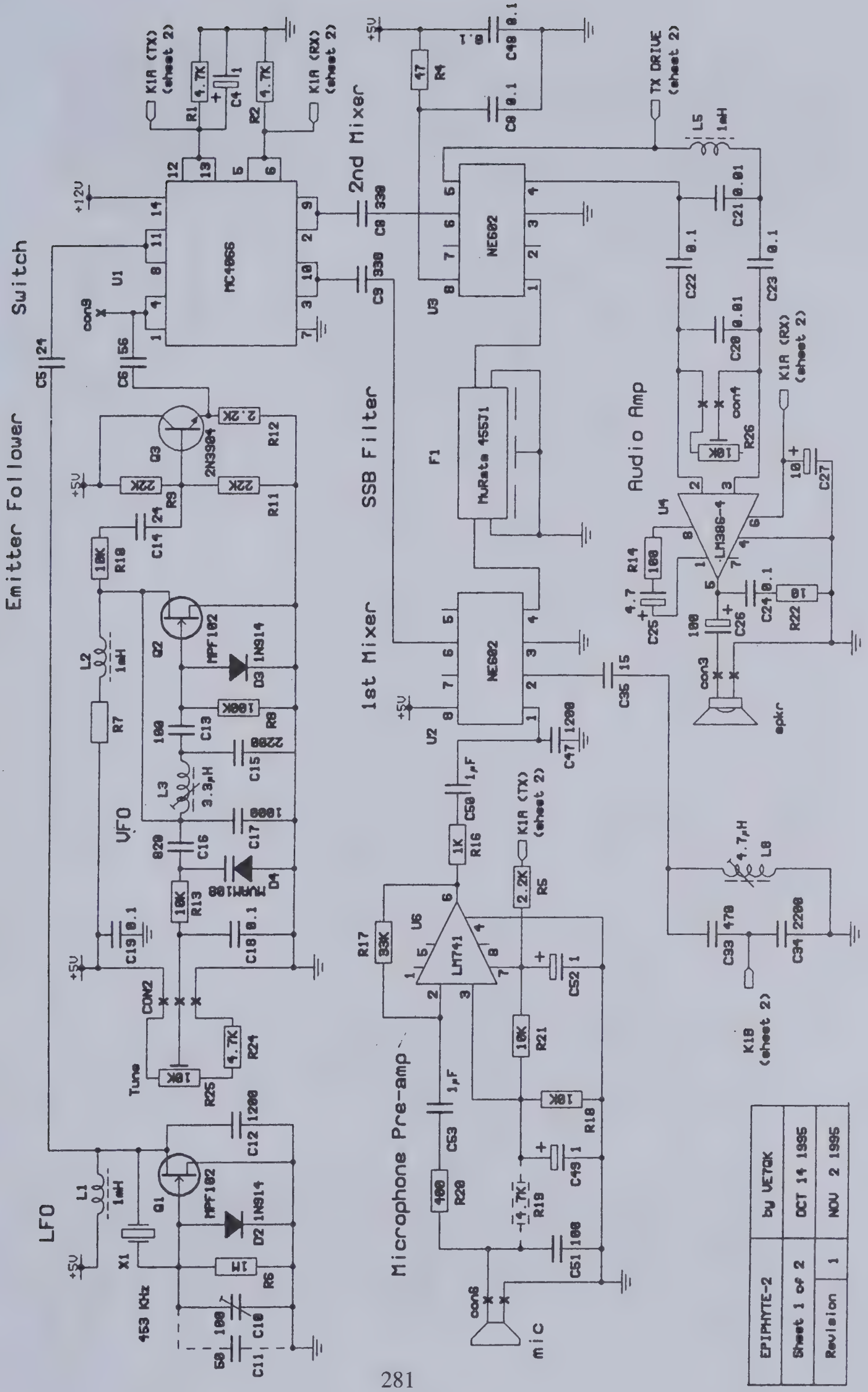
F1 455KHz SSB filter (MuRata 455J1)

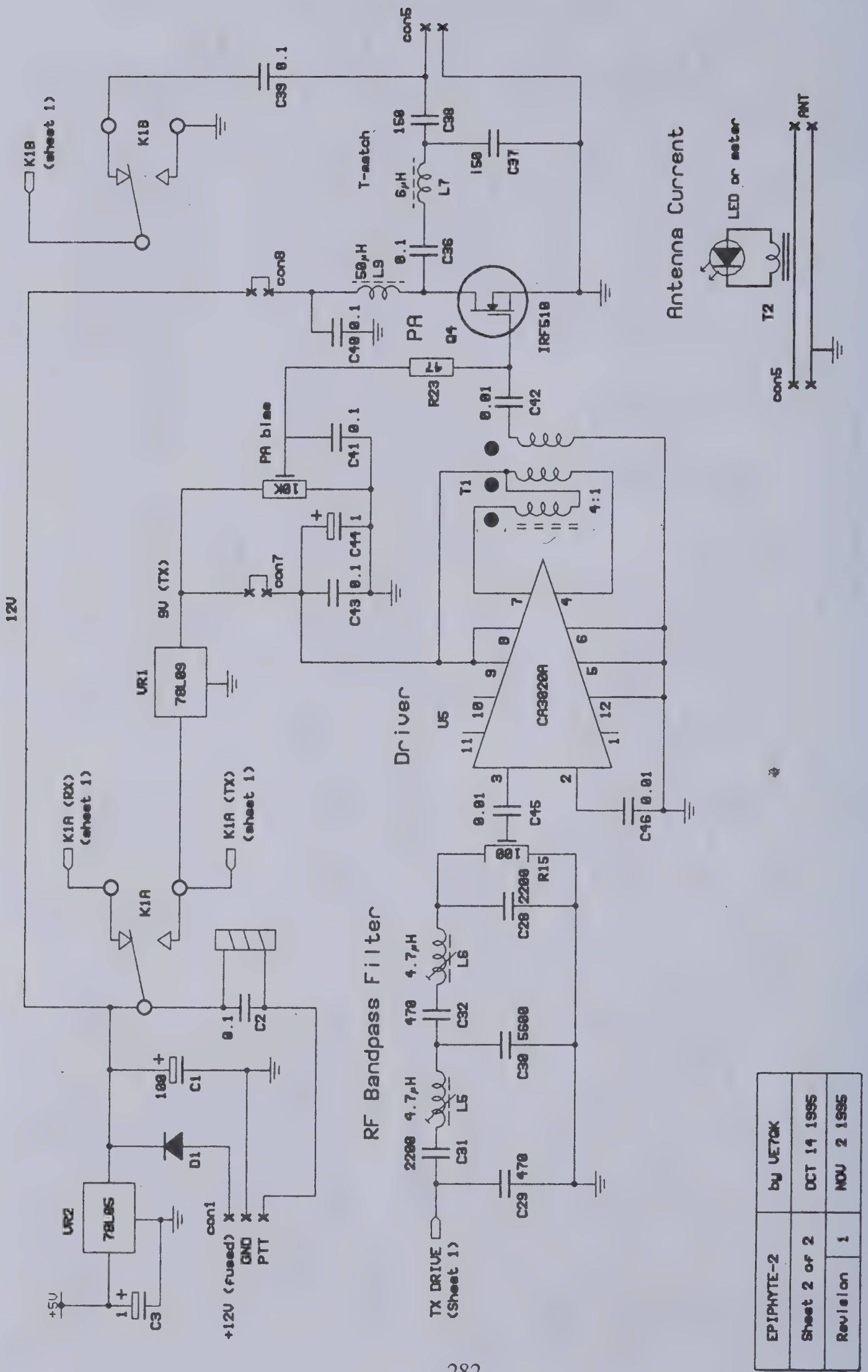
K1 miniature DPDT relay

X1 455KHz ceramic resonator
2 x 3-pin & 4 x 2-pin (Polarized Molex Terminals)
2 metering jumpers & terminals
1 x 1-pin test point

D1 "idiot diode" (optional)
D2 1N914
D3 1N914
D4 MVAM108 tuning diode

Heat sink (Q4)
4 x 4-40 metal stand-offs (3/16" x 1/4"H)
LED or meter to monitor antenna current
4 x 8, 1 x 7 & 1 x 8-pin chip sockets


LFO
Emitter Follower
Switch
2nd Mixer
SSB Filter
1st Mixer
VFO
Audio Amp
Microphone Pre-amp
Tune
MC4066
U1
NE602
U2
U3
MuRata 455J1
F1
LM386-4
U4
LM741
U6
MPF102
Q1
Q2
2N3904
Q3
1N914
D2
D3
MVAM108
D4
X1
453 KHz
L1 1mH
L2 1mH
L3 3.3μH
L5 1mH
L8 4.7μH
R1 4.7K
R2 4.7K
R4 47
R5 2.2K
R6 1M
R7
R8 100K
R9 22K
R10 10K
R11 22K
R12 2.2K
R13 10K
R14 100
R16 1K
R17 33K
R18 10K
R19 4.7K
R20 400
R21 10K
R22 10
R24 4.7K
R25 10K
R26 10K
C4 1
C5 24
C6 56
C8 330
C9 330
C8 0.1
C10 100
C11 50
C12 1200
C13 100
C14 24
C15 2200
C16 820
C17 1000
C18 0.1
C19 0.1
C20 0.01
C21 0.01
C22 0.1
C23 0.1
C24 0.1
C25 4.7
C26 100
C27 10
C33 470
C34 2200
C35 15
C47 1200
C48 0.1
C49 1
C50 1μF
C51 100
C52 1
C53 1μF
+5V
+12V
con2
con3
con4
con6
con9
CON2
K1A (TX) (sheet 2)
K1A (RX) (sheet 2)
K1B (sheet 2)
TX DRIVE (sheet 2)
spkr
mic
EPIPHYTE-2
by VE7GK
Sheet 1 of 2
OCT 14 1995
Revision 1
NOV 2 1995


RF Bandpass Filter
Driver
PA
Antenna Current
T-match
PA bias
12V
9V (TX)
+5V
+12V (fused)
GND
PTT
con1
con5
con7
con8
ANT
TX DRIVE
(Sheet 1)
K1A (RX)
(sheet 1)
K1A (TX)
(sheet 1)
K1B
(sheet 1)
K1A
K1B
VR2
78L05
VR1
78L09
U5
CA3028A
Q4
IRF510
T1
4:1
T2
LED or meter
D1
C1 100
C2 0.1
C3 1
C29 470
C31 2200
L5 4.7µH
C30 5600
C32 470
L6 4.7µH
C28 2200
R15 100
C45 0.01
C46 0.01
C42 0.01
R23 47
10K
C41 0.1
C44 1
C43 0.1
C40 0.1
L9 50µH
C36 0.1
L7 5µH
C37 150
C38 150
C39 0.1
1
2
3
4
5
6
7
8
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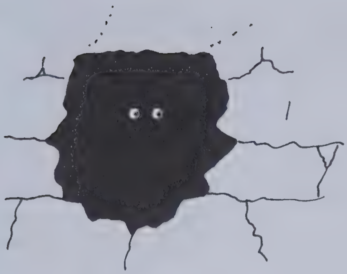
10
11
12
EPIPHYTE-2
by VE7QK
Sheet 2 of 2
OCT 14 1995
Revision
1
NOV 2 1995



The ROCK CRUSHER

John Hey, G3TDZ,
8 Armley Grange Crescent,
LEEDS LS12 3QL

The circuit offered while not being strictly amateur radio, is QRP, about 5W and is SSB, but not quite radio either. This project is interesting in that there are no inductors in sight, so there are no coils to wind. All Components are off-the-shelf industry standard. It is offered to allow constructors a glimpse into LF and VLF radio circuitry, and for those into such things, a cave communication system.

Observant Sprat readers will recognise the TX microphone amplifier and phase shift components are pinched from the G3TDZ phasing exciter. In place of the two 1496 balanced modulators, a much multiplexer C-MOS multiplexer offers useful savings at the working frequency of 87kHz. A further 4053 acts as transmit receive routing switch.

In place of tuned circuits or filters, a state variable filter using three LM318 op-lamps is switched in after the TX modulators on transmit, and on receive provides both selectivity and gain as RF stage. A crystal oscillator and divider 4060 drives a 4013 'D-type to generate the two quadrature signals required by a phasing system. Power output is from a domestic car radio chip TDA2003V at about 5W.

On receive the amplified RF signal passes to a section of the 4053 as mixer or product detector, after which a three pole low-pass filter cleans up the audio before the audio amplification. As with the old White Rose Receiver, the 6270 VOGAD chip is used as audio gain and AGC to drive the volume control, then an LM380 audio power stage.

In this application, a loop aerial is normal. A loop of more than one turn does not radiate an E-M wave past its own diameter, only an alternating magnetic field enhanced by the multiturn loop Again unlike real radio, the signal is subject to an inverse cube law so DX is unthinkable.

The frequency of 87kHz was chosen for no better reason than other cave systems use it. A 5.568MHz crystal is required and care in waterproofing essential if it is to be put into its intended use. The aerial has 12 turns of either 16-18SWG enamel, or better still, 6A PVC flexible mains wire. A one turn link winding couples the transmitter; on receive the whole winding feeds the RF stage. A 10n capacitor resonates the main coil.

In trials, one drawback has been identified: There are in some districts powerful beacons fairly close to our frequency. To avoid these, a lower popular frequency of 40kHz can be chosen; the modified values are shown below.

At the working frequency of 40kHz, the crystal should be 2.560MHz; R34 and R36 made 12k; R35 and R37 56 ohms; C14 and C15 at 330p. The aerial will have 16 turns and resonated with a 22n: a one turn link coil as before, wound in amongst the main tuned winding. As 10n and 22n capacitors tend to not be madly accurate, some playing may be necessary to achieve resonance on the nose.

It is hoped this unusual circuit has stimulated some interest if only as a "secret" radio telephone.

A Special Interest Project **This project from well-know SPRAT author G3TDZ is offered to members for their interest in the circuitry and approach to a particular problem. Readers who may wish to take this project further can obtain copies of a printed circuit board component listing and board layout by sending an SAE to G3RJV - mark envelope "Rock Cusher"**

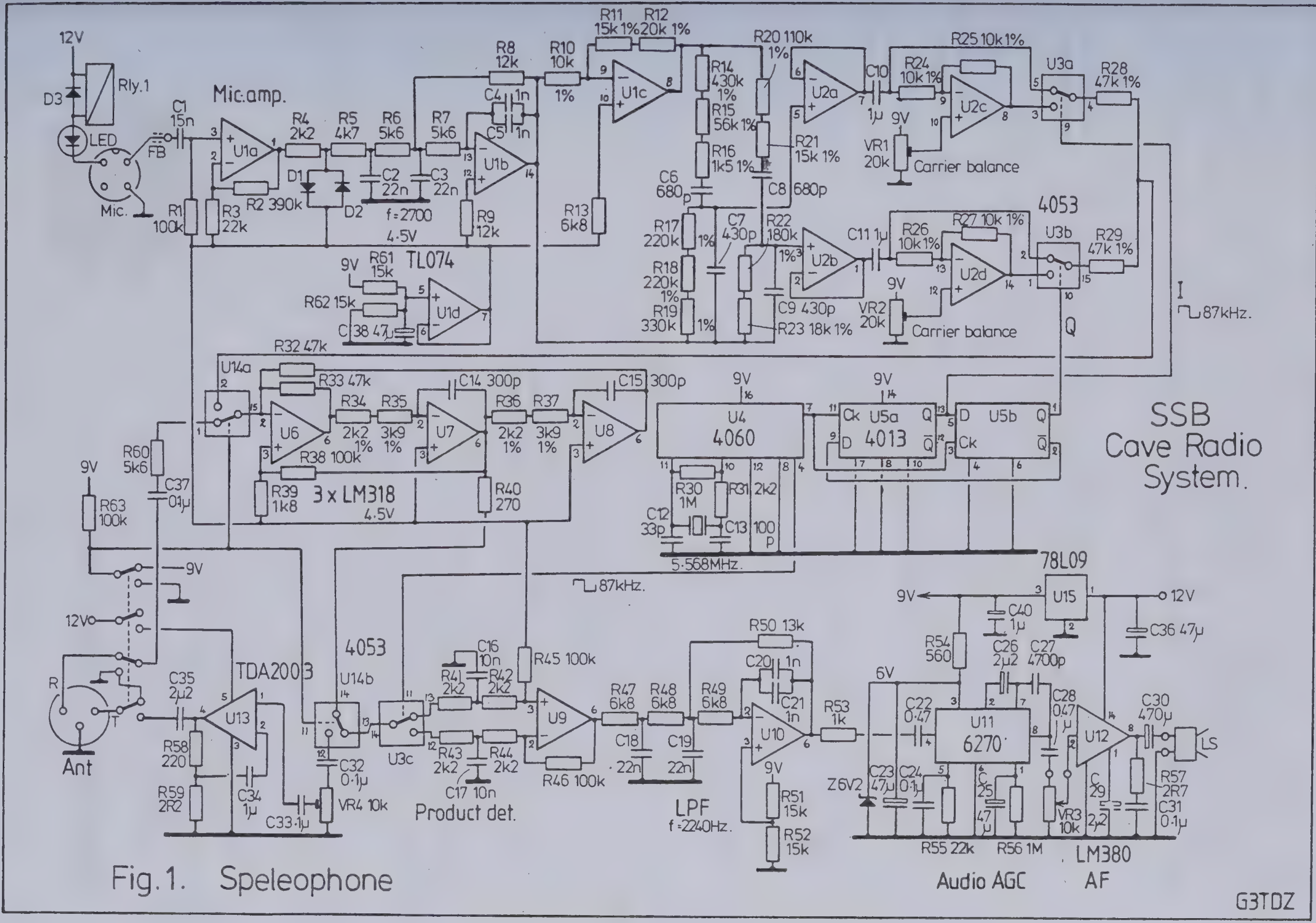


Fig. 1. Speleophone

MODIFICATIONS TO THE EPIPHYTE-2 TRANSCEIVER

Derry Spittle, VE7QK, 1241 Mt. Crown Rd., N. Vancouver, BC,
V7R 1R9, Canada e-mail: jds@freenet,vancouver.bc.ca

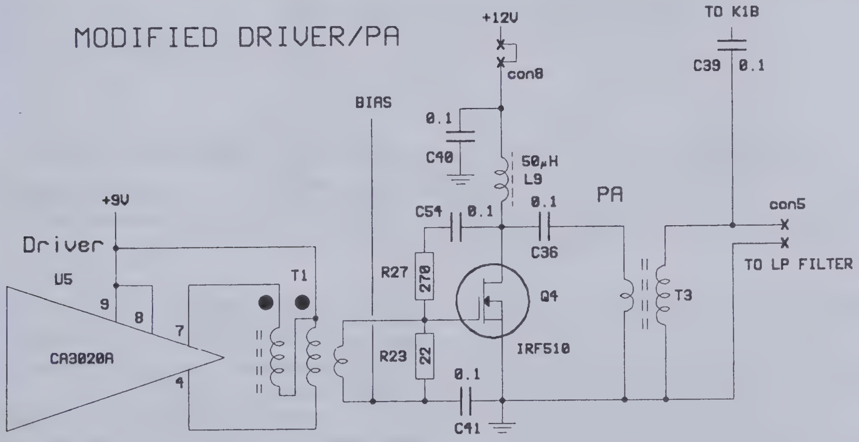
Since my construction article was published in the the last issue of SPRAT I have found the T- match to the antenna somewhat intolerant of any inductive load such as a LP filter or tuner. Changing to a more traditional broadband transformer eliminated the problem. In addition, the input resistance at the gate of the IRF510 has been reduced, the drive transformer (T1) modified to effect a better match and some shunt feedback added. One correction. L5 (1mH RFC) on Sheet 1 of the Schematic should have been numbered L4.

Anyone who has already made a PCB from the printout in SPRAT may effect these modifications using existing pads and traces and drilling only a couple of additional holes. To avoid removing and rewinding T1, the unused winding may be left in place and the new 2t. coupling wound over. Those ordering boards from Hands Electronics will find the PCB has been modified to accomodate these changes and a revised Parts Layout is available.

The EP-2 gave a good account of itself in the recent ARCI QRP SSB Contest. Despite poor band conditions, 45 daytime contacts were made on 75M throughout BC, Washington and Oregon using an inverted-Vee antenna 25ft high at the apex.

EPIPHYTE 2 OFFERS : REPRINTS and PCBs

A **Reprint of the modified EP2 circuits** is available **from G3RJV** for a self addressed, stamped, envelope.
PRINTED CIRCUIT BOARD (including the above modification and corrected circuit + layout)
£7.00 including postage (£7.50 EU, £8.00 DX)
HANDS ELECTRONICS, TEGRYN, LLANFYRNACH, DYFED. SA35 0BL



COMPONENTS CHANGED OR ADDED
C37, C38, C42 & L7 ELIMINATED
T1 MODIFIED (5 bifilar t. + 2t. sec.)
R23 REDUCED TO 22 OHMS
T3 ADDED (2t. prim., 5t. sec. on Amidon BN-43-202)
R27 (270 ohms) & C54 (0.1µF) ADDED

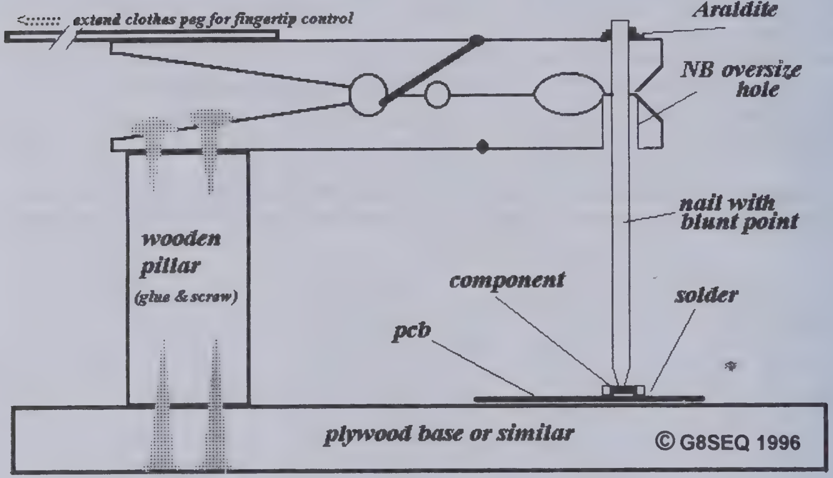
A JIG FOR HOLDING SMD PARTS

John Beech, G8SEQ 124 Belgrave Road, Wyken Coventry CV2 5BH

This jig is a simplified design based upon a version of the now defunct BRE company jig. It has been "value engineered" to make it as cost effective as possible. Since even the humblest amateur radio shack or workshop would have all the necessary materials to hand, it is not proposed to offer it as a kit of parts!

No dimensions are given either as none are critical, with the proviso that the length of the nail and the height of the pillar should be adjusted to give a firm but not excessive pressure to hold the component in place. If the point of the nail just touches the base-board when the peg is fully closed, it should be about right. The point of the nail should be dressed with a fine file or emery to remove any burrs.

JIG for holding SMD parts.



TWO TIPS FOR CONSTRUCTORS: Doug Mepham, G4ERA.

As I am continually changing layouts, I don't get round to making printed circuit boards. I use doubled sided printed fibre glass boards, cutting two slots for IC pins to come through and Araldite the IC holder to the board. I find drilling one hole for each IC pin far too fiddly.

The other dodge is that mounting wire ended crystals is awkward when neither pin is grounded. The wire ends fir neatly into an IC holder. I have recently completed a receiver with 4 crystals in the IF filter and they fit nicely into a 14 pin IC holder.

PW SEVERN BUILDERS BEWARE: Although an old circuit (PW May-Aug 1983) the PW Severn is still being built. The BF256 FET is available in several types types BF256A/B/C and L all of which have different pinouts. The one required is the BC256L

FOR SALE - BEESWAX BLOCKS for coil and component fixing, as featured by G3ROO in RadCom, Send a £1 coin suitably disguised (taped to card) and your return address to : Gareth Evans, G4XAT, G QRP 2817, 7 Westland Drive, Hayes, Bromley, Kent. BR2 7HE.

A TUNEABLE 455kHz BFO

Doug DeMaw, W1FB, PO Box 250, Luther, MI 49656. USA

Many amateurs own 455-kHz mechanical filters that were purchased without the matching USB and LSB BFO crystals These crystals are very expensive. A quick and cheap solution for receiver builders is a tuneable BFO Fig. 1. Shows a practical circuit.

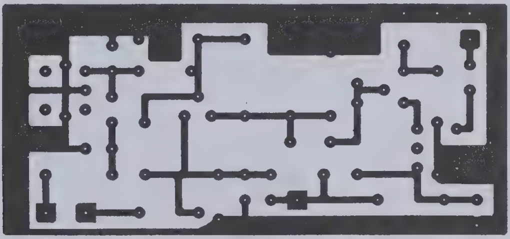
L1 and T1 are transistor radio 455-kHz IF transformers. D1 is a tuning diode with a nominal capacitance of 56 pF C1 determines the amount of frequency change via R1. The frequency shift is 4.5 kHz with the values shown R12 is added only if Q2 self-oscillates when T1 is tuned for resonance.

A quality 2-watt carbon control is best for R1 to ensure longevity from frequent use. A 10-turn helipot and dial would make tuning less critical. Avoid getting peak output with the T2 slug at the upper end of its range. This gives rise to maximum output at 910 kHz. The slug should provide a 455 kHz peak at midrange.

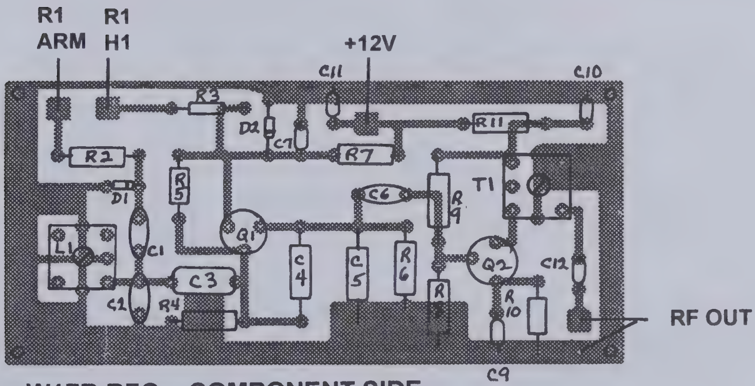
Fig 2 is a scale PCB pattern as viewed from the etched side. Fig. 3 shows the parts placement as seen from the component side of the PCB.

This circuit may also be used as a carrier generator in an SSB exciter. Two Trimpots and a SPDT switch may be substituted for R1 to provide preset LSB and USB operation

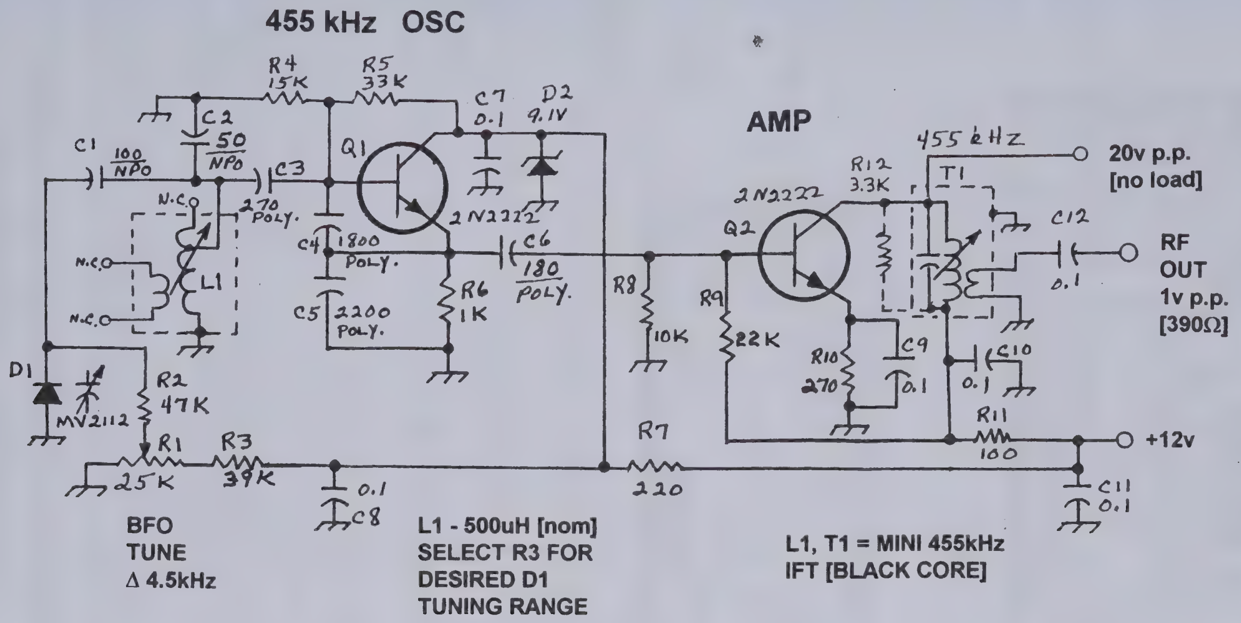
Frequency stability is good. I measured 65 Hz of short-term drift from a cold start to one minute later. Thereafter, random drift was plus-minus 6 Hz with the circuit enclosed in a shield box at a room temperature of 70 degrees F.



W1FB BFO ETCHED SIDE



W1FB BFO COMPONENT SIDE



BFO
TUNE
Δ 4.5kHz

L1 - 500uH [nom]
SELECT R3 FOR
DESIRED D1
TUNING RANGE

L1, T1 = MINI 455kHz
IFT [BLACK CORE]

FIG.1

DOUG DEMAW
9-24-96

W1FB BFO CIRCUIT

A DIRECT DIGITAL SYNTHESISER

Mick Hodges, G4OPE, 40 Ennersdale Rd. Coleshill, Birmingham. B46 1EP

The Direct Digital Synthesiser described has been designed to replace the 5MHz free running VFO commonly found in multi-band HF transceivers. The board also includes logic for switching 10 bands and three modes, EEPROM storage for 100 memories and two low pass filters. The board can be configured via the keypad for use with transceivers covering any number of the HF bands, and reverse tuning can be selected for some or all of the bands used as required. A second mode of operation will produce any frequency between DC and 15MHz in 1Hz steps for use as a general purpose Signal Generator.

Circuit description

PIC16C74

The microcontroller communicates with most other devices using programmable I/O pins, some configured as interrupt lines. Port D is used as a bi-directional parallel bus and two pins of port E are used as serial data and serial clock lines. The device contains 4096 x 14-bit EPROM programme memory, 192 x 8-bit general purpose SRAM, 45 special function hardware registers and 33 I/O pins.

AD7008

The direct digital synthesis IC is a numerically controlled oscillator using a 32-bit phase accumulator and integrated 10-bit D/A converter. A 32-bit frequency programming word is sent to the IC using the parallel bus and the frequency is calculated as follows:

$$freq = \frac{\text{32-bit word} \times 50\text{MHz}}{2^{32}}$$

Two 32-bit registers are available for frequency information storage, the logic state of the FSELECT pin determines which register is used. The two registers are programmed with TX and RX frequencies and, unless RIT is selected, will be the same. When RIT is selected the two frequencies differ by the RIT offset. The FSELECT pin is used for TX/RX switching but can also be used for FSK by selecting RIT and tuning to the difference between mark and space frequencies, logic is then sent to the pin.

I_{out} is a high impedance current source with full-scale current controlled by the resistor (R_{set}) connected to the FSADJUST pin and calculated as follows:

$$I_{out} = \frac{6233 \times V_{ref}}{R_{set}} \qquad \text{where } V_{ref} = 1.27\text{V nominal}$$

A value of 390Ω for R_{set} will supply 20mA into the 50Ω load resistor.

Keyboard

Port pins RB4 - RB7 are programmed as inputs and pulled high internally, pins RB0 - RB3 are outputs and programmed low. RB4 - RB7 are also programmed as interrupt-on-change pins. When a key is hit, one of the interrupt pins will be pulled low and the PIC is made aware of keyboard activity.

Shaft Encoder

RC0 is programmed as an input pin while RC1 uses a capture and compare module interrupting the processor with each rising edge. Output from the encoder is two pulse trains, one lagging the other by 90 degrees, with 50 pulses per revolution. Tuning direction is determined by reading RC0 immediately after each interrupt.

LCD

A Hitachi LM016L LCD with two lines of 16 characters is used for the display. The LCD uses the bi-directional parallel bus, together with three control lines. Display information is stored in the LCD RAM which the PIC reads or writes to as required.

74HC195

Two 74HC195's are used as band select and mode logic for switching external crystals or oscillators, and programmed using the serial data and clock lines. Information is sent to both devices simultaneously, with the first 8 bits latched onto the output pins of the first device, and the following 8 bits latched onto the output pins of the second. Maximum current sourced from each pin must be limited to 35mA.

74HC163
A 4 bit binary counter is programmed to divide the 50MHz oscillator by 16, providing the PIC with a 3.125MHz clock signal.

93LC66
A serial EEPROM is used for memory storage with 4K bits arranged as 256 x 16 bit locations. Two locations are used to store frequency and mode information providing 128 memories. Only the first 100 memories (00 - 99) are user programmable with locations 100 and above used by the PIC to store configuration information. Separate read and write lines are used together with chip select and clock signals

74HC4066
A 15MHz low pass filter is used between the DDS output and a 74HC4066 quad analogue switch. The signal is available at the YB pin at all times but the signal at YA is switched off by the PIC when the DDS is used as a DC-15MHz Signal Generator. Normally, the 5-6MHz signal at YA passes through a 6MHz low pass filter ready for connection to the transceiver.

Operating instructions

Entering frequencies

Simply type in the frequency and hit the `ENT` key. Include the decimal point and as many of the remaining six digits as required, zeros will be added to short entries.

```
Example     14.25 ENT        14.250000 MHz
               7. ENT         7.000000 MHz
         28.48392 ENT        28.483920 MHz
```

The digits before the decimal point are used to programme the band select logic and the remaining digits are added to 5MHz (or subtracted from 6MHz if reverse tuning is selected) and sent to the DDS.
Each time a frequency is entered with the keypad or a memory is recalled, the new displayed frequency and mode are stored to EEPROM. When the DDS is powered up, the last frequency and mode stored in this way is read and displayed. To store a frequency tuned with the shaft encoder ready for next power-up simply hit the enter key.

Memories

At any time the displayed frequency and mode can be stored to any one of 100 memories, (00 - 99), by pressing the `STO` key followed by a two digit location. To recall a memory press the `RCL` key followed by the two digit location. Memories remain in EEPROM when power is removed from the board.

Example.	`STO 23`	**frequency and mode stored to location 23**
	`RCL 23`	**recall that same frequency and mode**

After recalling a memory, the location is displayed on the LCD and remains until the encoder is turned or a new frequency is entered.

Example	`3.561450 MHz 23` `CW`	**memory 23 recalled**

When an empty location is recalled, the DDS is programmed with the base frequency of the lowest band previously configured using function 7, and the mode selected is CW.
The `STO` and `RCL` keys are disabled when the Signal Generator mode has been selected.

Functions.

Nine functions are used to set operating modes or select/deselect features of the DDS. Press the `FNC` key followed by the function number and follow the on-screen prompts. Press the `CLR` key to abandon selection.

1 - RIT
Function 1 is used to enable or disable RIT.

Example	FNC 1 1	**enables RIT**
	FNC 1 2	**disables RIT**

Entering a new frequency will disable RIT and recalling a memory will zero the displayed RIT if enabled.

When enabled the RX frequency offset is displayed below the TX frequency together with a + or − sign, and the shaft encoder now tunes the offset. The RX frequency is the sum of the two, allowing for the sign. When the TX/RX pin on the board is grounded, the frequency tuned is that shown on the top line.

Example	21.257212	**TX frequency = 21.257212MHz**
	+0235	**RX frequency = 21.257447MHz**

2 - Mode
Function 2 is used to change between USB, LSB and CW.

Example	FNC 2 1	**selects USB**
	FNC 2 2	**selects LSB**
	FNC 2 3	**selects CW**

Three pins of the second 74HC595 are used to switch mode. The CPU will programme the corresponding pin high, the remaining two pins are programmed low.

3 - Tuning steps
Function 3 is used to select tuning step size.

Example	FNC 3 1	**selects 1Hz steps**
	FNC 3 2	**selects 10Hz steps**
	FNC 3 3	**selects 100Hz steps**

As the shaft encoder is turned, the frequency is incremented or decremented by the step size selected. Tuning below the band edge or above the band edge will cause the frequency to roll over, i.e. tuning below 7MHz with 1Hz steps will tune 7.999999MHz.

4 - Erase all memories
A memory location can be overwritten simply by storing a new frequency and mode to that location. Function 4 is used to erase all 100 memories at once and reset the default band and tuning direction configuration.

Example	FNC 4 1	**erase all memories**
	FNC 4 2	**cancel erase**

5 - Sweep band
Function 5 is used to initiate sweeping of the band, either up in frequency or down.

Example	FNC 5 1	**sweep up**
	FNC 5 2	**sweep down**

Sweeping can be stopped by any one of the following actions:

1 - Striking any key on the keypad.
2 - Turning the shaft encoder.

3 - Grounding a dedicated pin on the board.
4 - If the key pressed to start sweeping is held down, sweeping will stop when the key is released.

The dedicated pin may be driven with external circuitry used to detect a signal, and so provide a search feature

The tuning step size will set the rate at which the band is swept between 40Hz/sec and 4KHz/sec.

6 - Scan memories

For the purpose of scanning, the 100 memories are divided up into 10 banks of 10 memories each. Function 6 is used to start scanning one of the ten memory banks. The first location of the selected bank is recalled and held for two seconds before moving on to the next, after the tenth memory is recalled the sequence is repeated. Any of the methods used to stop sweeping will also stop scanning.

Memory banks are numbered as follows

Bank 0	00-09
Bank 1	10-19
Bank 2	20-29
etc	

Example	FNC 6 0	**scan memory bank 0**

7 - Config bands

By default, the DDS board will accept entry of any frequency in any HF band. When used with a rig that does not cover all bands, it may be desirable to reject the entry of out of band frequencies. Function 7 is used to configure the DDS to accept frequencies in only the bands of interest. This function is a little different from the previous functions, pressing FNC 7 will bring to the display the current configuration in the form of ten binary digits. The leftmost digit represents Top Band with the rightmost digit representing 29MHz. A 1 indicates that the band is selected with a 0 indicating a deselected band. Simply overwrite the current configuration with 1's and 0's to select or deselect each band and press the ENT key. The new configuration is stored to EEPROM and read each time the DDS is powered up.

Example	FNC 7	1111111111	**all bands configured**
		0100100000 ENT	**80m and 20m only**

8 - Config direction

The default tuning direction is 5-6MHz as the displayed frequency is increased. Some rigs may require reverse tuning where the output decreases (6-5MHz) as the displayed frequency is increased. Function 8 is used to configure some or all of the bands for reverse tuning. This function is similar in use to function 7. Again, ten binary digits are displayed showing the current configuration, a 1 represents normal tuning and a 0 represents reverse tuning. Overwrite the current configuration and store to EEPROM with the ENT key

Example	FNC 8	1111111111	**all bands normal tuning**
		1111100000 ENT	**Top band through 20m normal, 15m through 10m reverse tuning**

9 - Signal Generator.

The DDS can be used as a general purpose Signal Generator and will produce a 1volt pk to pk sine wave from a second 50Ω source on the board. Any frequency from DC to 15MHz can be programmed in 1 Hz steps

Function 9 is used to select this mode.

Example	FNC 9 1	**selects the Signal Generator**
	FNC 9 2	**return to transceiver mode**

The RCL and STO keys are disabled in this mode, and only functions 3, 5 and 9 are available.

Specifications

Output frequency:	5-6MHz or DC-15MHz
Impedance:	50Ω
Amplitude:	1V pk-pk max
Accuracy:	+/- CMOS clock inaccuracy, +/- 0.1Hz
Current consumption:	160mA

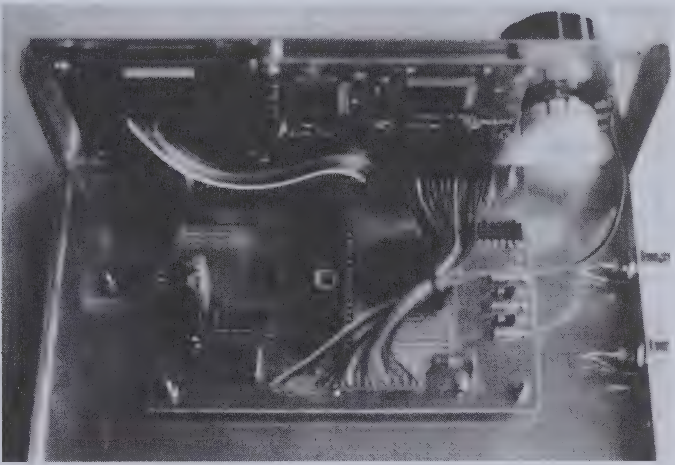
DIRECT DIGITAL SYNTHESISER : A CLUB KIT OFFER

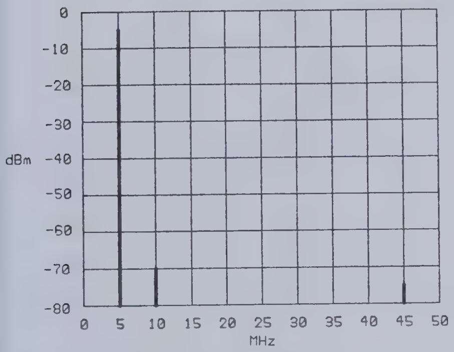
A Full Kit for the G4OPE DDS will be available shortly. The kit includes PCB, all board parts, keypad, LCD display and a shaft encoder. The Member's Price is £105. (Registered postage inc. insurance £5.00) Overseas Airmail postage : Europe - £6.00, DX - £11.00. Cheques to G QRP Club. Visa/Mastercard available for overseas members - include Card Number/ expire date, Name, Callsign, Club number

Orders to : **Mr. Ian Wye G0OKY, New House, Hook Road. Amcotts, Nr. Scunthorpe. DN17 4AZ.**

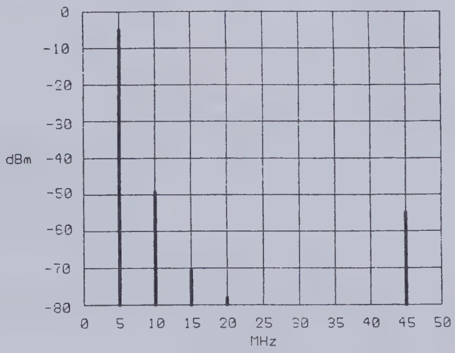
We expect to be able to make kits available by mid February. This is a limited number offer.

Below : The Prototype of the G4OPE Direct Digital Synthesiser





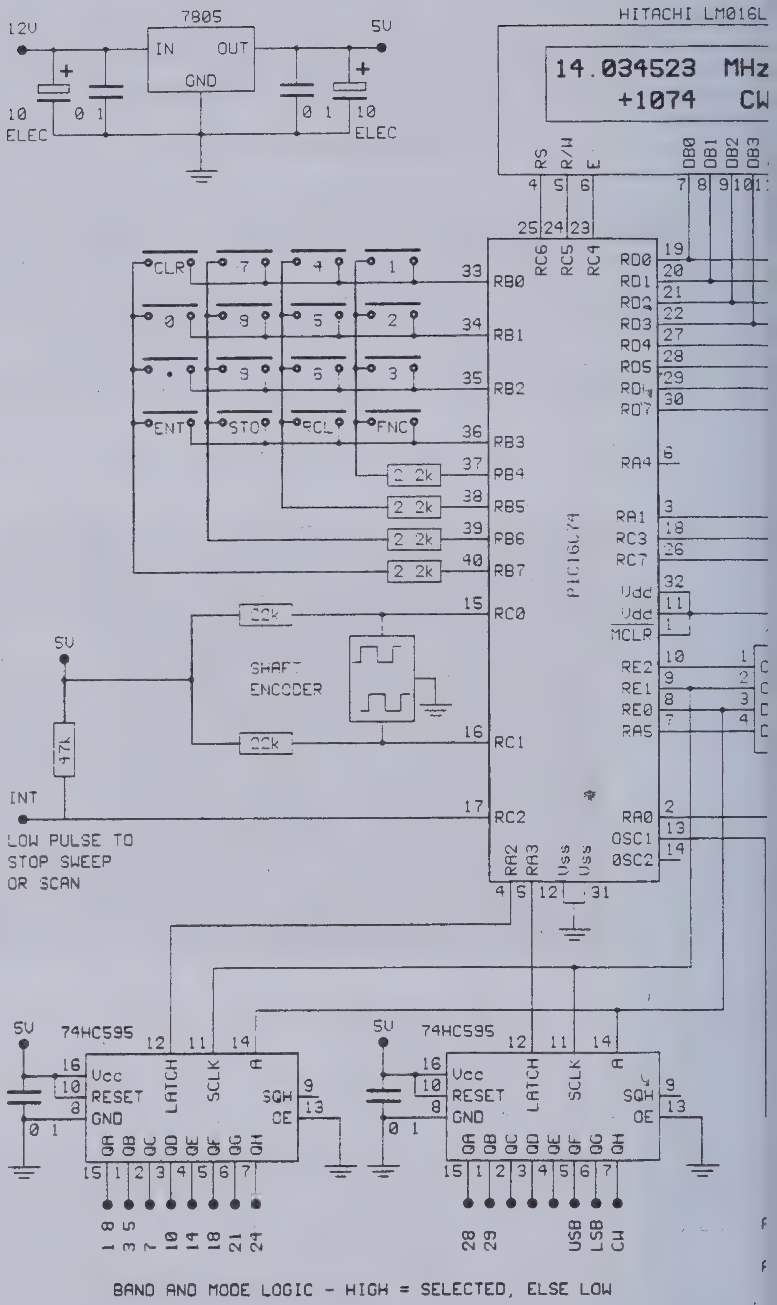
DDS tuned to 5MHz 5-6MHz output

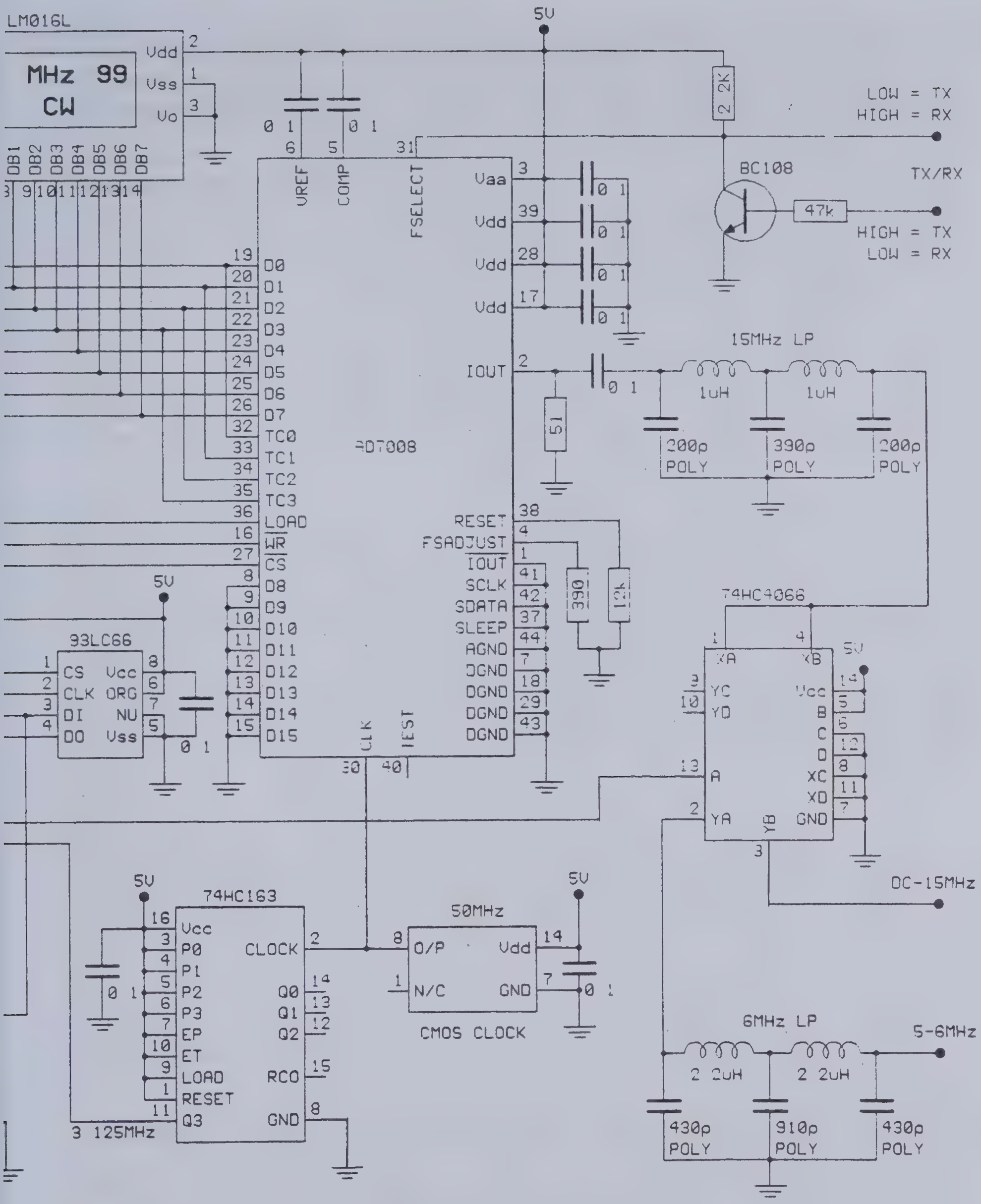


DDS tuned to 5MHz DC to 15MHz output

A DIRECT DIGITAL SYNTHESISER by Mick Hodges G4OPE

The Circuit Diagram - A Full Size circuit diagram is available for an SAE to G3RJV





ALL CAPACITORS DISC CERAMIC UNLESS OTHERWISE NOTED

ALL RESISTORS 10 PERCENT 1/3 WATT

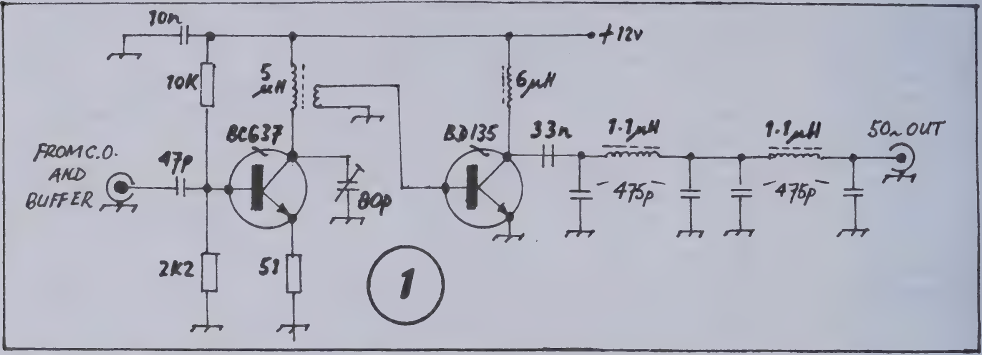
MICK HODGES G4OPE

Destroy Subharmonic Resonances in Transistor PA Tank Circuits!

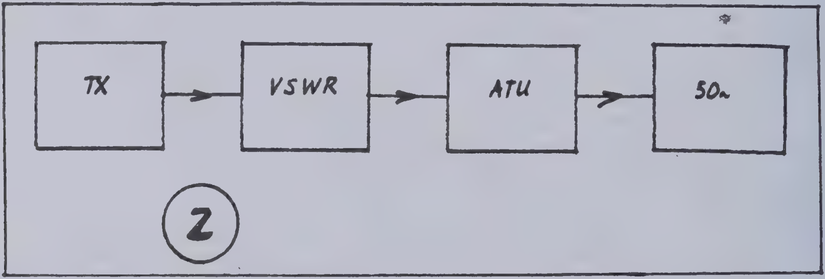
Some observations and ideas concerning Tuned Transistor PAs

Ha-Jo Brandt DJ1ZB, EICHENWEG 7, 84160, FRONTENHAUSEN, Germany

If You see a TX circuit like that in Fig. 1, would You recommend any principal changes? As long as its users seem to be pleased with it, I surely would not, because it is a straightforward design which can be found in many QRP publications. For my own purposes, however, I would have designed some details differently, and others might assume this just to be my personal style.



But if a question is raised:" How to design a transistor PA circuit free from parasitic oscillations at a VSWR of 2 or higher", I would propose definite changes in the circuitry of Fig. 1 to cure the problem. This was the situation when preparing the themes to be discussed at the 1996 meeting of the German G-QRP-C members at Pottenstein. DK6SX, himself author of several QRP publications, had raised this question. Fortunately, he could also provide me with a PCB of the 7 MHz TX of Fig. 1, to test out my ideas.



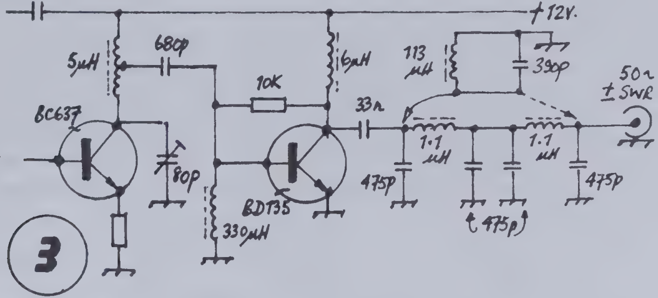
Driver to PA coupling

Firstly, I have asked the coupling between driver and PA to be changed from inductive to capacitive coupling, as discussed earlier in SPRAT Nr. 64; Autumn 1990. This change however, shown in the driver section of Fig. 3, did not cure the main problem. After the main problem had been solved, this coupling problem has been re-examined, confirming that capacitive coupling is insensitive to PA load changes whilst there remains a tendency to parasitic oscillations when employing inductive coupling. This may also depend on the type of PA transistor and its collector-to-base capacitance.

Test circuit for creating definite PA load VSWR.

For all VSWR tests the setup of Fig. 2 had been used, the ATU being my "Mini ATU" from SPRAT Nr. 57, Winter 1988/89. In general, the ATU should contain a series tuning capacitor, because the 50 ohms dummy load must not be able to load the transmitter output at low frequencies.

At VSWR = 1, the transmitter delivered 1.5 watts to the dummy load. After the VSWR had been increased to 2 by tuning the ATU, the circuit continued to deliver output power even with the key open Oscillations ceased after a short interruption of the supply voltage but started again when pressing the key for a short moment. With a simple absorption wave meter (a frequency calibrated resonant circuit combined with a diode RF detector, coupled to the TX by a wire loop through one of the low pass filter toroids) it could be shown that the emitted power consisted of the wanted 7 MHz carrier with additional sidebands roughly +/- 1 MHz apart.



Additional parallel circuit

Guided by earlier experiments, I then designed a simple parallel resonant circuit for 7 MHz with an operational Q of 1 (both reactances XL = XC = 50 ohms), consisting of a 390 pF styroflex capacitor and 18 turns on a T50-6 toroid (1.3 æH). As soon as this circuit had been connected in parallel to the TX output filter, as shown in Fig. 3, the parasitic oscillations ceased immediately and could not be reactivated even by a higher VSWR. At VSWR = 1, output remained at 1.5 watts.

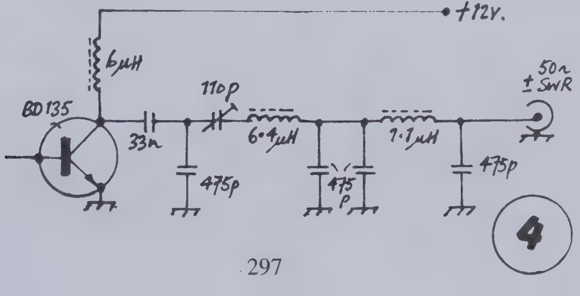
Additional series circuit

After disconnecting the parallel circuit of Fig. 3, a series resonant circuit had been added to the first coil of the PA low pass filter, thus forming a peaked low pass filter. The total series arm of the first filter section then consisted of a T50-6 toroid of 40 turns (L = 6.4 æH) and a 110 pF foil trimmer (Fig 4). The trimmer was tuned at VSWR = 1 for maximum output (again 1.5 watts). At higher VSWR, the output decreased, of course, but without any tendency of instability.

BD226 PA

But something else happened: The PA transistor BD135, carrying no cooling fan in this experimental setup, was destroyed, because without oscillations collector dissipation increased with higher VSWR. Another BD135 was not available, therefore it had been replaced by a BD226 This is a similar transistor, but capable of higher output power at higher drive. A cooling fan had also been applied.

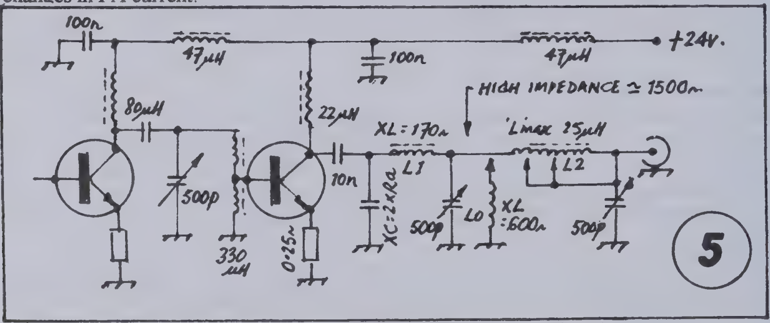
In the original circuit of Fig. 1, the BD226 output had been 1 watt only No attempts have been made to change or optimize the match between driver resonant circuit and PA input (after having measured the internal capacitances later I guessed this should have been done). The output power could be increased to the former level of 1.5 watts by placing an RF bypass capacitor across the driver emitter resistor. With the BD226 the original transmitter showed a tendency for oscillations at much lower VSWR, even close the VSWR = 1. But again, after the output tank had been changed to either Fig. 3 or Fig. 4, no instabilities could be initiated by tuning to higher VSWR. What may be the reason for this behaviour?



Frequency division in transistor PAs

I have experimenting with transistor PAs since 1960, and, for financial reasons of course, very often have tried transistors with a reasonable high Ft, but which were not especially designed for RF applications. Around 1968, the aim had been to develop a fieldday transmitter employing a TO-3 case transistor with an Ft of 60 to 100 MHz. Especially on one occasion it had been very difficult to achieve sufficient output power at 14 MHz. But suddenly, after retuning the PA, plenty of power could be obtained, but at quite unusual high L and C settings. Finally a check with a frequency absorption meter confirmed that the output power had been on 7 MHz!

This had been my first experimental proof that transistors, especially those with high collector-to-base capacitances and when driven hard (typical for class C applications) are capable of frequency division. This is an entirely new aspect compared to tube transmitters and must also influence tank circuit design.
On the same transmitter mentioned I had also been experimenting with a double Pi tank circuit of Fig. 5, capable of matching cable fed aerials (50 ohms nominal) as well as high impedance long wires. In the field, no problems were noticed with long wires, but when the PA had to be tuned to a 14 MHz beam, there were problems. When searching for the optimum match there were settings with definite instabilities, with excessive changes in PA current.



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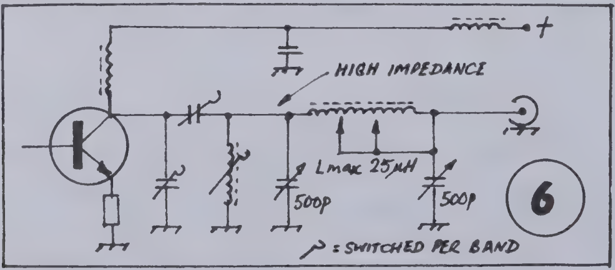
What was the difference? Long wires were open ended for all frequencies, but the balun of the beam presented a low impedance at low frequencies. In this configuration, the double Pi tank could inhibit additional resonances at lower frequencies. These resonances would not be loaded and therefore be very sharp. When these resonances were passing through 7 MHz or 14/3 MHz during tuning, for instance, frequency division occurred.

The simplest way to destroy the subharmonic resonances was to add a parallel circuit for the wanted frequency to the double Pi network. The Q of this circuit must not be high, values of 2 to 3 should be sufficient. In reality, just the coil Lo was needed; the capacitance could be provided by the centre variable capacitor (Fig. 5).

To reduce the tank circuit to two coils, the network had been simplified to that of Fig. 6. This solution had been employed in my first 5-band 2 W cw qrp transmitter (PA 2N3553) of 1968 (DL-QTC March 1971), also in the Lagos QRPeter (SPRAT Nr. 23; Summer 1980) and my first 10 MHz transmitter (SPRAT Nr. 31; Summer 1982). In many years of service, and with several types of coax-fed and random wire aerials, no instability problems were noticed.



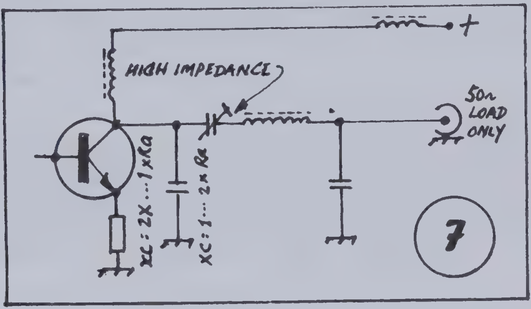
6

Other designers' problems

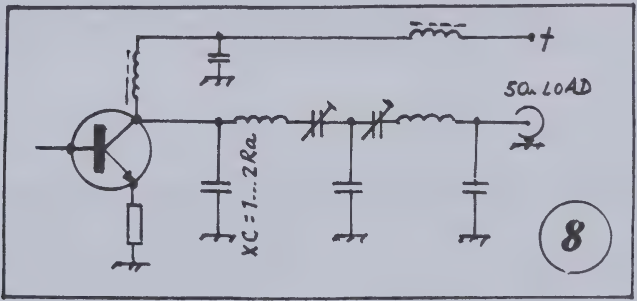
From this period, I remember an article by Ade Weiss, K8EEG, emphasizing the need for a coil in parallel to the PA tank output, to stabilize a transmitter. Also, when DL7AV designed the 100 watt transistor PA for the DL0IGI 28.204 MHz beacon using a Philips BLX15, he also found a parallel coil necessary as soon as a multi section low pass filter had been added to the basic application circuit as published by Philips. DL7AV knew about my subharmonics theory, because we had been colleagues for almost three decades.

Peaked low pass filter

In the eighties I have been looking for another tank circuit avoiding subharmonic resonances without the need for a parallel coil. This resulted in employing a "peaked low pass filter" (Fig. 7), as KN1H has called it (SPRAT Nr.58; Spring 1989). Typical applications were in the TTL transmitters (SPRAT Nr. 51; Summer 1987) and the FO transmitters (SPRAT Nr. 64; Autumn 1990). In contrary to the previous designs, these transmitters were tuned for a fixed 50 ohms output load, and were used in conjunction with the "Mini ATU" mentioned earlier, also without any instability problems.



The peaked low pass filter has the same number of components as a single section low pass filter, including a capacitor to block the PA collector voltage. But unlike the low pass filter it is not broadband. It must be tuned (peaked), and it may be given a Q of 5 to 10, as in tube transmitters (this being a difference to the parallel resonant circuit of Fig. 3, which effectively destroys subharmonic resonances even with a Q of 1). And it provides much better harmonic suppression and also offers attenuation at lower (and subharmonic) frequencies. In contrary to the ordinary low pass filter it may also be used for impedance transformation (necessary to obtain more output power than 1.5 watts from a 12 volts supply).



Better harmonic suppression

Future requirements concerning harmonic suppression may lead to a combination of a peaked low pass filter followed by a conventional low pass, or the combination of two peaked low pass filters (Fig. 8). The T connection of the three capacitors in the centre of Fig. 8 may be converted to a equivalent Pi connection

(Fig. 9). This may be an advantage when designing a tank circuit capable of matching loads up to a VSWR of 3 or so, because in this case the rotors of both tuning capacitors are at ground potential. For fixed tuning for 50 ohms loads only, both circuits are equal.

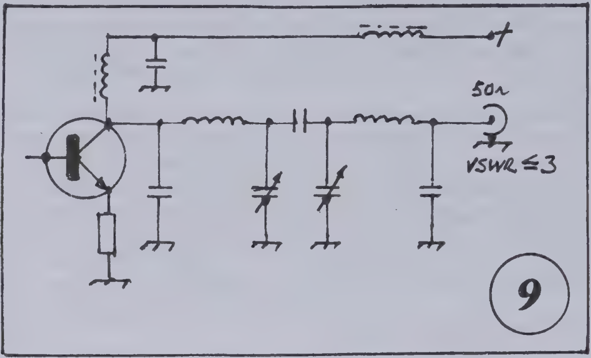


Fig. 1 circuit with various loads

It is not generally known among radio amateurs that multi-section low pass filters may exhibit additional resonances in the pass band if they are not properly terminated for all frequencies. The exact analysis of this problem in conjunction with the PA collector choke is rather complex and an interesting task for computer aided design programmes. The simplest low frequency resonance is formed by the inductivity of this choke and the sum of all low pass capacitors to ground, for the low pass coils may be neglected at low frequencies.

Most cable fed aerials will show a nominal impedance of 50 ohms only at one or a few specific frequencies. Therefore, the transmitter may behave differently from being connected to a 50 ohms dummy load. The behaviour of the aerials may also depend on the circumstances whether a balun or a lead choke is employed at the feed point or not (The groundplane of DK6SX had a lead choke). As shown, the introduction of a resonant circuit for the wanted frequency band can decouple the PA transistor from possible subharmonic resonances and thus prevent instabilities due to frequency division.

Effects of transistor capacitances and driver resonant circuit

In the data sheets of transistors recommended for general purpose and audio applications such as BD135 or BD226, usually no values for internal capacitances are given. To get some additional insight into the problems mentioned, the capacitances of these types had been measured, employing a resonant circuit connected to a diode RF voltmeter and exited by a signal generator.

Table 1. Transistor capacitance values:

type	**capacitance**	**12.5 volts**	**5 volts**
BD135	Ccb	17.5 pF	25 pF
BD135	Ceb	-	640 pF
BD135	Cce Base open	-	31 pF
BD226	Ccb	13 to 15 pF	10 to 22 pF
BD226	Ceb	-	250 pF
BD226	Cce base open	-	30 to 33 pF
MRF476	Ccb	25 to 35 pF	-

Comparison to a MRF476 PA

DL1GKE has built the 14 MHZ version of the "VXO controlled CW Transmitter for 3.5 to 21 MHZ" from the 1988 ARRL Handbook, section 30-43, employing two MRF476 in parallel in the PA followed by a multi section low pass filter (Fig. 10). This has given the opportunity to test this transmitter too for possible instabilities at higher VSWR. Therefore, the datasheet values of the Ccb of the MRF476 were included in table 1.
However, this transmitter did not show those parasitic oscillations observed and treated in the former chapters, and this in spite of the fact that the sum of the collector to base capacitances of this PA is much higher than of the PA in Fig 1. But the difference to Fig. 1 is that the ARRL transmitter does not use a driver resonant circuit, but a broadband transformer.

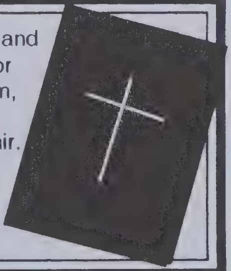
Therefore it seems that the conditions for the instabilities treated here are as follows: There must be a transistor PA with a tuned input and output tank, and the output must shows additional resonances at subharmonic frequencies. From this reasoning it could be deduced that commercial boradband amplifiers with push-pull PA might be free from this problem. But this is not generally true: The well known FT-7 QRP transceiver employing a 10 watts push-pull PA also shows instabilities when connected to high VSWR loads. When connected to an ATU, a match can only be found if a pre-load is used to limit the maximum VSWR to 2

Within broadband amplifiers, there are other problems. The driver current of the ARRL QRP transmitter had to be more than 100 mA for sufficient excitation of the PA, causing an unusual high voltage drop across R12. The match between driver and PA using a bifilar step-down transformer was far from optimum. Therefore I have changed the circuit and tried a tuned driver output. Due to the better match obtainable, the driver current could be reduced by 50%! Therefore I think that the tuned transistor transmitter has still a roll to play in amateur radio techniques.

There was another type of instability in the ARRL transmitter: By tuning to a certain phase at rather low VSWR, a hiss sound in the VHF receiver could be generated. This problem could be cleared by converting the output circuitry to a transforming peaked low pass filter followed by a conventional low pass filter (thus eliminating the step-up broadband transformer and providing some capacitance directly from both collectors to ground).

This tendency to VHF noise shows that, for the suppression of VHF frequencies, it is not advantageous to separate the first capacitor of the output low pass filter from the PA collectors by an inductive device like a broadband transformer. I have no personal experience with these broadband designs yet, but have looked up in the schematics of commercial japanese push-pull PAs, that both collectors are directly bypassed to ground by rather high ceramic disc capacitances, e. g. 220 pF to 1000 pF, for 10 to 100 watts PAs. Obviously, the broadband transformer to 50 ohms is mainly designed to pass the fundamental frequency and the lower harmonics to the 50 ohms output filter. Higher harmonics are directly bypassed to ground at the PA collectors.

All these details show, that there is a lot of specific know-how hidden in the heads of some key designers, and the final chapter on how to design transistor PAs, either broadband or tuned, has not yet been written.



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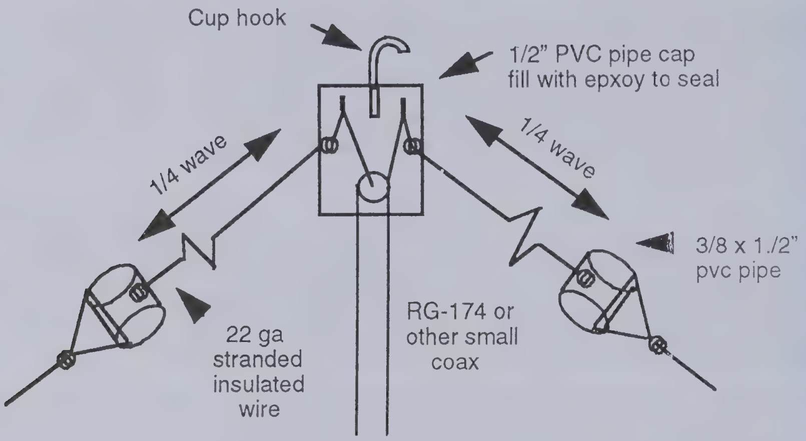
See Internet Web Page HTTP://www.G0PPQ.demon.co.uk

PVC GUSHER ANTENNA MOUNT : For Dipoles

Joe Everhart, N2CX, 214 N.J. Road, Brooklawn, NJ. 08030. U.S.A.

A lightweight inexpensive inverted vee dipole for portable operation, adapted from the BIC Flame-thrower from Fred Turpin, K6MDJ. Radiator wires are attached to insulators by passing them through clearance holes and knotting. Coax passes through clearance hole drilled in end of pipe cap and soldered to dipole wires. Seal around coax with model aeroplane cement then fill cap with epoxy. Cup hook screws into epoxy to hang the antenna.

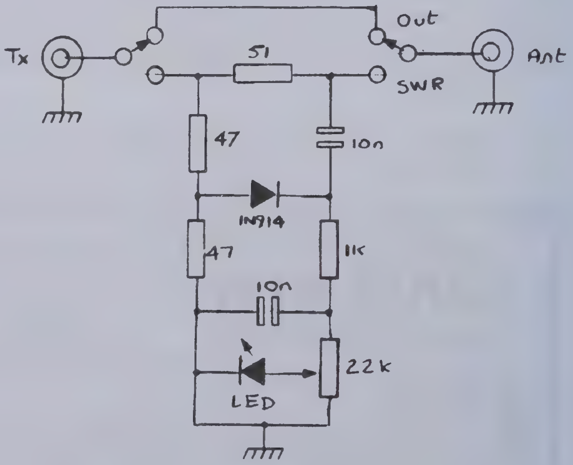


SIMPLE LED SWR BRIDGE

John Young G0WQR, 19 Wycombe Rd. Princes Risborough. Bucks HP17 0EE

Inspired by G4TKV's comments about Superbright LEDs, see RadCom (TT May 1997), I modified the popular QRP SWR Bridge by replacing the micrometer with a superbright LED. Unlike ordinary LEDs, the Superbright will glow with a current of less than 10 micro-amps.

With less than 1 watt output from the TX, the LED is fully illuminated and extinguishes as the load is matched for minimum VSWR. Easy to use and it takes up little panel space – ideal for that miniature QRP rig.



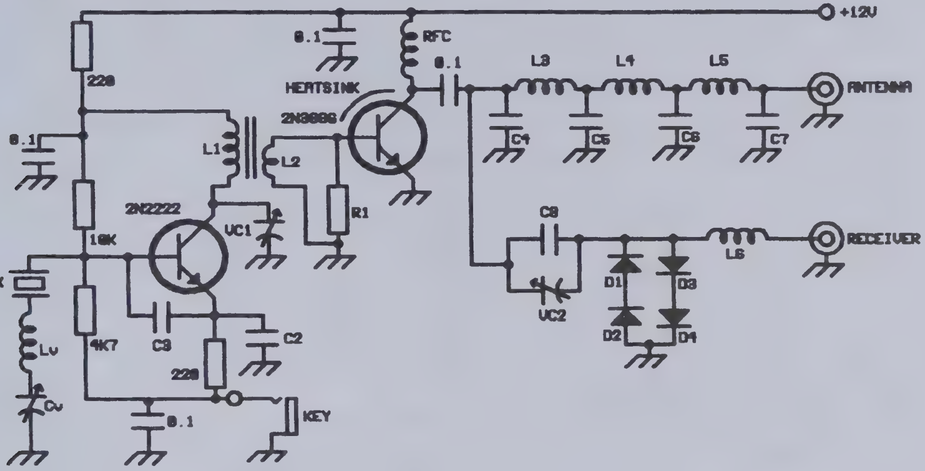
THE G3RJV SIX PACK : SIX ONE NIGHT CONSTRUCTION PROJECTS

At the Dayton Hamvention "Four Days in May" symposium this year, G3RJV presented a series of simple projects to encourage home construction.

The projects came with a printed circuit board containing all six projects on sub-boards which snap off from the full board plus all the parts to build the projects.

Following several requests - these projects are now shared with SPRAT readers.

KANGA KITS SPECIAL OFFER - £25.00 + £2 pp - LIMITED 100 RUN ONLY
The "snap-off" Printed Circuit Board + All Parts for All Projects

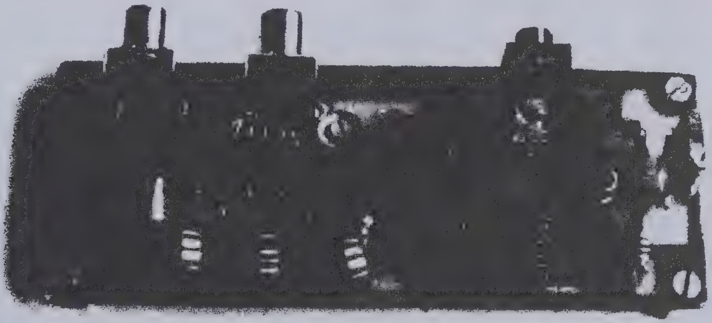


[1] THE PLUG AND PLAY TRANSMITTER

The PLUG AND PLAY TRANSMITTER is a re-working of the W7ZOI Universal Transmitter to include several new features:

- A Better Lowpass Filter - following the W3NQN constants
- Full Break-in Change Over circuit
- A VXO (Variable Crystal Oscillator as the RF source

The whole transmitter builds on to one board with input/output sockets and yields 1 watt of RF output on the selected band. Values are given for four popular amateur bands. The constructor merely chooses the values from the band table for the preferred band. Adjust VC2 for the best compromise between transmit and receive.



VALUES FOR PLUS AND PLAY TRANSMITTER

BAND	VC1 *	C2	C3	R1	RFC	L1	L2
3.5	120p	100p	220p	39	25uH	43t T50-2	6t
7.0	120p	100p	None	39	15uH	35t T50-2	5t
10.1	60p	47p	None	47	15uH	35t T50-6	4t
14.0	60p	33p	none	47	15uH	27t T50-6	4t

* Murata 5mm Ceramic Trimmers [120p - Black, 60p - Brown]
Wind L2 over the "VC1 end" of the L1 winding. L1 occupies ¾ circum. of core.

VALUES FOR THE PLUG AND PLAY TRANSMITTER LOWPASS FILTER

Band MHz	C4,7 pF	C5.6 pF	L3,5 turns	L4 turns	Core	Wire swg
3.5	470	1200	25	27	T37-2	28
7.0	270	680	19	21	T37-6	26
10.1	270	560	19	20	T37-6	26
14.0	180	390	16	17	T37-6	24

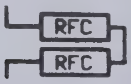
Note : Wire gauge is not critical.
Use size to comfortably fill the core about three-quarters of full circumference.

VALUES FOR CHANGE-OVER BREAK-IN SYSTEM

COMPONENT	3.5	7.0	10.1	14.0
VC2 Trimmer	120pF	120pF	35pF	35pF
C8 Disk	47pF	47pF	47pF	NOT USED
L6 : FT37-61	22 turns	14 turns	11 turns	11 turns

The VXO Circuit : The values for Cv and Lv are open to experiment.
Suggested values are:

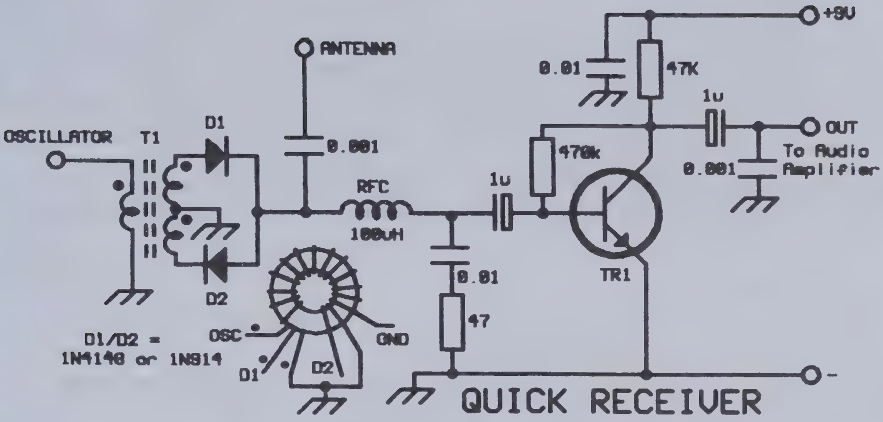
BAND	3.5	7.0	10.1	14.0
Lv	39uH	33uH	22uH	22uH
Cv	100p	60p	60p	60p



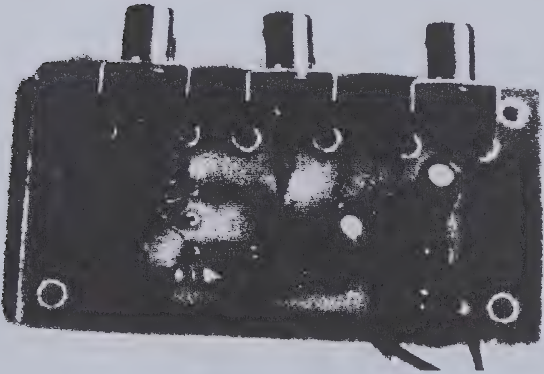
Experiment with a wider swing VXO. DJ1ZB introduced the idea of placing two inductors physically next to each other to increase the VXO swing using mutual inductance between the two inductors. The inductors are placed as shown on the left.

Experimental Values to Try: These are just suggestions - try your own values.
3.5MHz - 39 + 39uH 7MHz - 39 + 33uH
10.1 - 22 + 15uH 14MHz - 15 + 15uH

[2] THE QUICK RECEIVER



T1 is 8 turns trifilar wound on FT37-61 Core



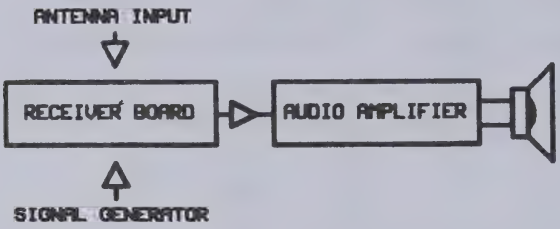
THE QUICK RECEIVER BOARD was born of necessity. Some time ago I was in need of a test receiver to listen to some SSB signal generated at 9MHz. At that time I did not have a receiver which covered 9MHz so decided to build one for myself.

The circuit is simple and basic : a passive mixer formed by D1 and D2 feeds an audio pre-amplifier TR1. To make a receiver the board requires a oscillator signal and an audio amplifier. Most people have a small utility audio amplifier and a signal generator to complete the receiver.

The board requires about half a volt of signal injection into T1 and about 80dB of audio amplification after TR1. There is no input tuning although this could be added at the antenna input port.

The board is easy to build. If you go wrong, it will be winding L1. Trifilar transformers are easy … on the second one. Lightly twist together three lengths of enamelled wire (about 8 twists to the inch will do) and wind them on the core as one winding. The dot marks the "start" end of each winding. Join them in the circuit exactly as shown. Get it wrong and it won't work!

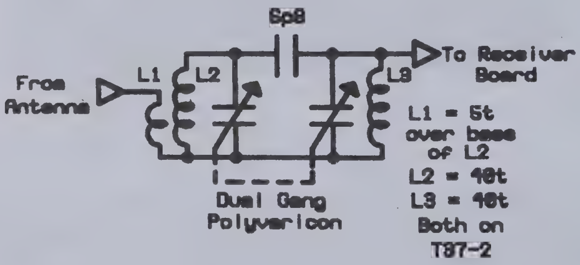
Although the board was built for one specific purpose, it has remained a useful piece of test equipment as well as a stand-by receiver for odd frequencies not covered by my other equipment.



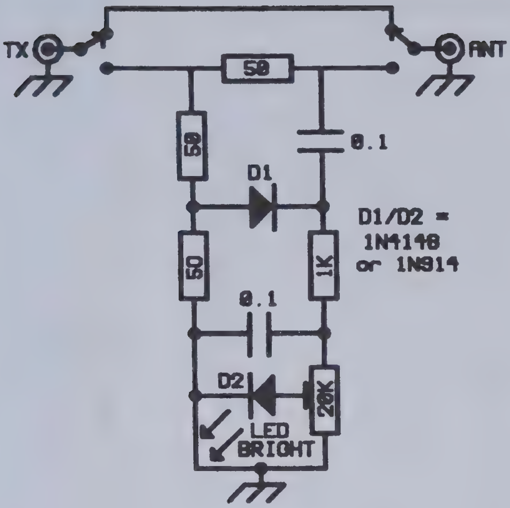
How to use the Quick Receiver Board.

Want to add a Bandpass Filter to the input?
This will give a little selectivity and make it more like a conventional receiver. The circuit below tunes from about 3 to 15MHz and is inserted between the antenna and the antenna input on the Quick Receiver Board. It uses a surplus two-gang polyvaricon tuning capacitor culled from a transistor AM radio. If you want to add any more features - you might as well build a proper receiver!

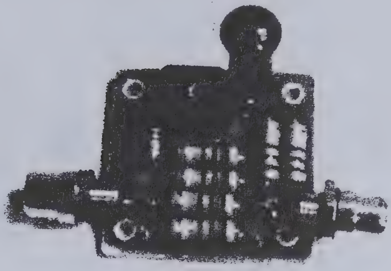
The Suggested Bandpass Filter



[3] LED STANDING WAVE INDICATOR



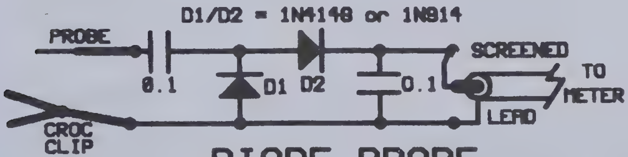
LED SWR MONITOR
50 = 2X100 1W



John Young, G0WQR, offered this little circuit to the readers of SPRAT 93. This just puts it on to a PCB. The basic circuit is that of a Resistive SWR Bridge.

The SUPERBRIGHT LED is remarkable in that it will still glow when dissipating currents of 10 microamps or less. As the antenna is tuned for minimum VSWR, the Superbright LED will extinguish. The preset provides a sensitivity control and the indicator will work with signal to below 1 watt. BUT… switch out the circuit after tuning up and before transmitting.

[4] A DIODE PROBE

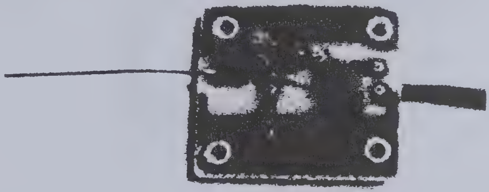


DIODE PROBE

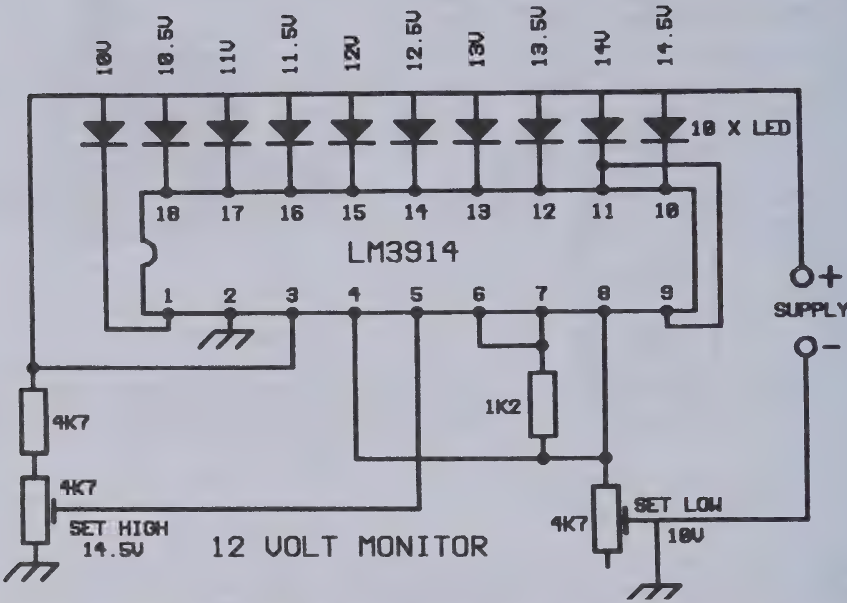
The beginner at radio construction sometimes assumes that they will have to invest heavily in test equipment. Most QRP projects can be built with the minimum of test equipment. The basic need is an analogue multimeter. Digital ones are nice but most times we are more interested in changes in reading rather than finite readings. The next essential for RF work is a diode probe. Anyone who buys one of these should be ashamed - it is just a "crystal radio on a stick".

The circuit shows a basic peak reading diode probe for RF signal tracing and measuring. It would be possible to add a series resistance to get a RMS reading probe but the voltages in QRP RF work are usually quite low and usually the purpose of the probe is to adjust RF levels in circuits.

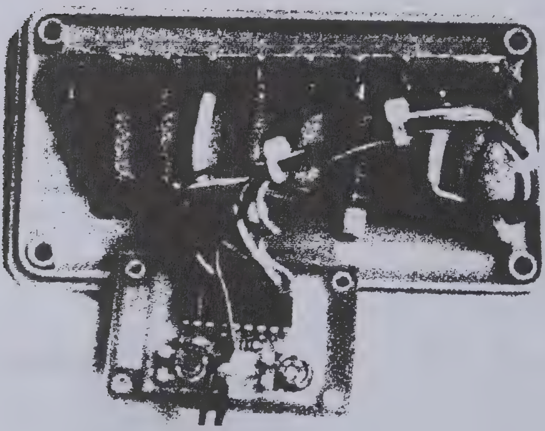
A sharp pointed wire makes a probe and a crocodile clip is the ground connection. The leads between the probe and the VOM must be screened to avoid RF pick-up. The PCB provides top and bottom screen panels to attach to the main PCB using stand-off pillars or extra bolts.



[5] A VOLTAGE MONITOR

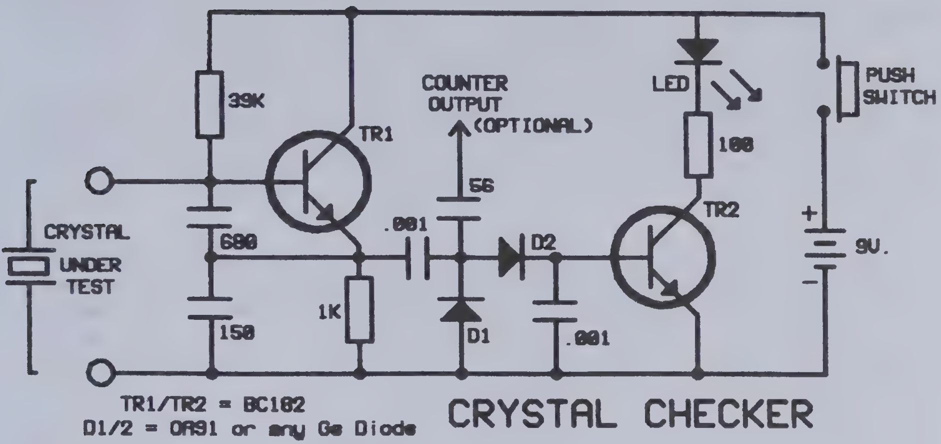


The Indicator uses an LM3914 Dot/Bar Display Driver Chip. The LM3914 lights up to ten LEDs (in the Bar mode) or one of 10 LEDs (in the Dot mode) in response to an input voltage. The chip contains a voltage divider and 10 comparators that turn on in sequence as the input voltage rises. There is an internal reference voltage source that can be used to set high and low reference points on two pins at either end of the voltage divider chain to adjust the range of measurement.

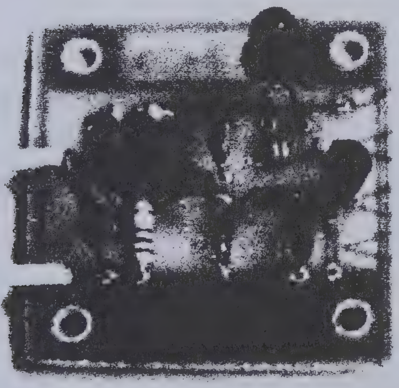


The battery (or supply) being monitored provides the operating voltage. The LM3914 operates with any supply voltage from 3 to 18 volts. A preset potentiometer feeds the input to pin 5. This is used to set the highest reading point. Another preset control sets the low reading voltage using the internal reference voltage. Pins 1 to 10 feed the LEDs. Setting up is simple. The left preset control sets the high voltage and the right preset sets the low voltage readings.

[6] SURPLUS CRYSTAL CHECKER



This is a little pocket tester for those surplus crystals sometimes seen at amateur radio events. The avid constructor is always looking for good deals and money saving. It does pay to search around the smaller tables and pick up inexpensive crystals. Even if they are not on an amateur band, some crystals will mix with another frequency to hit a desired band. But do those surplus crystals work? This little circuit is simple to use. Simply attach to crystal to the clip leads and press the button. If the LED glows - the crystal is oscillating. It also has a facility for measuring the frequency of unknown crystals.



The circuit is very simple. T1, a generic NPN silicon transistor, is configured as a Colpitts Oscillator which works from about 2 - 20MHz. The oscillator output is taken from the emitter of T1 via a 1000pF capacitor. A small value capacitor (56pF) couples this signal to an optional socket for a digital frequency meter. A phono, or similar socket may be added to the case to provide output to a digital frequency counter. Two diodes rectify the signal and produce a DC voltage on the base of T2. T2 functions as a DC amplifier with an LED in the collector. If T1 is oscillating, T2 will conduct and the LED will glow. A good crystal produces output from the LED.

My prototype was built in a small case with enough space to include a 9-volt PP3 battery. The crystal connection leads come out of the front of the box and are terminated with crocodile (alligator) clips. The LED protrudes through the front panel and the push switch is on the end of the box.

The JBS Transmitter [JUNK BOX SPECIAL]

A Simple Transmitter Capable of a Full 5 Watts of RF Output

George Burt GM3OXX, 6 Glenside Ct. Armadale, BATHGATE. EH48 3RX

A W1FB MEMORIAL AWARD WINNER

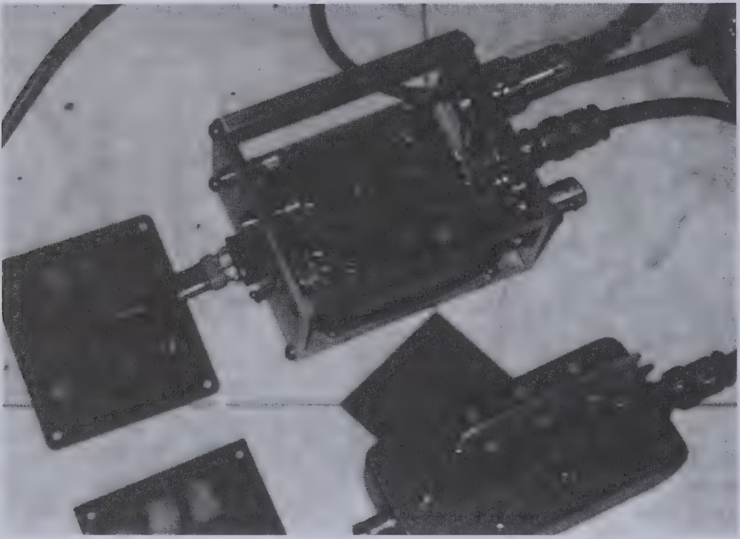
The **J**unk **B**ox **S**pecial is a simple transmitter which works on 6 HF bands and can almost be QRO on the lower bands. The prototype was built on blob-board but the PCB version is offered here. The chart shows the expected power levels for the various bands. The first day on-air using 80, 40 and 20 at the one watt level yielded 13 countries worked including 4X4PT and N4RO/\/QRP with a 28 metre doublet in the plastic rain gutter only 2 metres up!

The transistors are available from Grandata: the 2N2905 at 20p and the 2SC2166 at 80p. The bad news is that the RF Choke is critical. The type I used is 1mH with a series resistance of 33 ohms. These are available from JAB Electronics [Cat. p.50 - part # RS228-208] for £2.70. If you use other RF Chokes with lower series resistance, add a small value resistor, up to about 30 ohms. I did try other chokes and obtained more power output but TR1 can overheat, so stick with 30 ohms. The trimmer is 9 - 90pF. The 470pF coupling capacitor was chosen as the best compromise for the 6 bands.

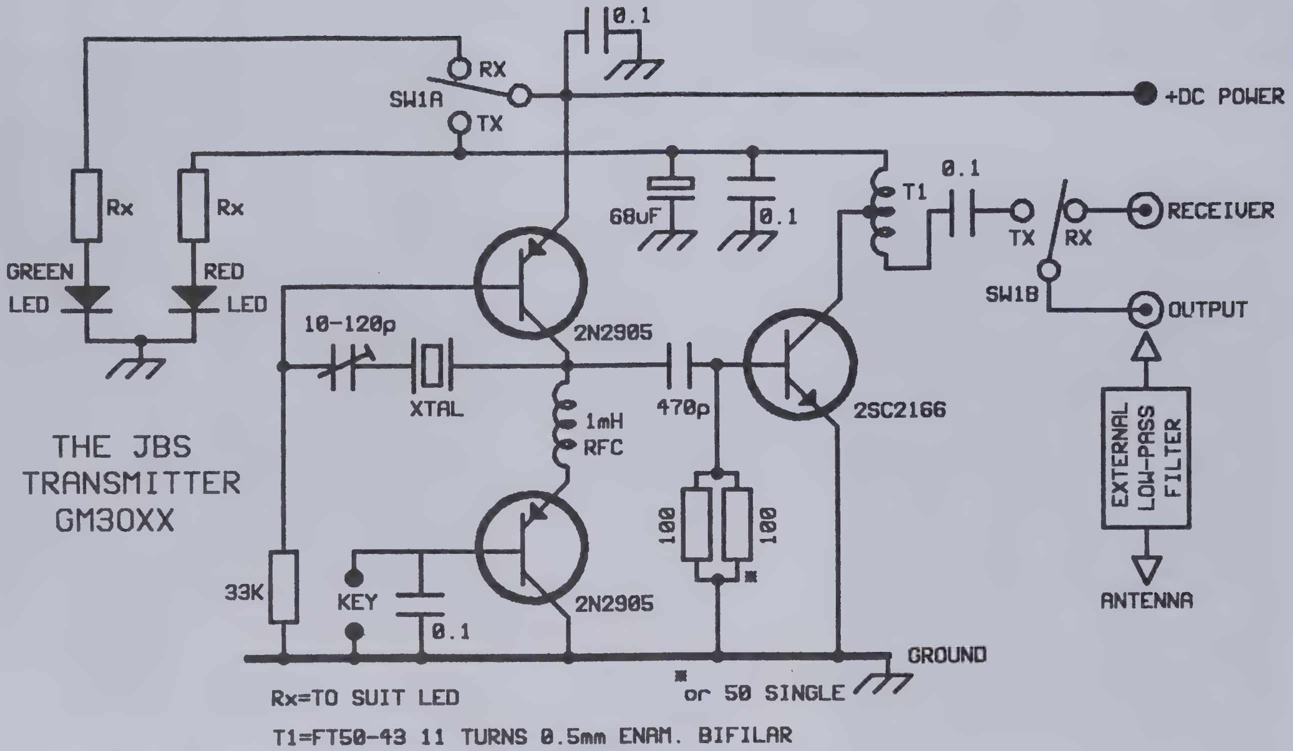
The use of a wide spaced PCB makes construction easy for the beginner. T1 is the most difficult part. I used an FT50-43 with 11 bifilar turns, using the technique described by Zack Lau [see later].

The LEDs can be omitted - they only indicate Transmit/Receive status. I used the ones with the built-in series resistors. Heatsinks are fitted to the PA and Oscillator transistors. A lowpass filter is required for the band in use. I used my plug-in lowpass filters.

The operation is simple:
In receive mode [green LED] press key to net, switch over to transmit [red LED] and key to transmit.



PROTOTYPE JBS UNDER TEST WITH ANOTHER PCB : LEFT AND PLUG-IN LOWPASS FILTER BOX : FRONT


THE JBS
TRANSMITTER
GM30XX
+DC POWER
SW1A
RX
TX
0.1
Rx
Rx
GREEN
LED
RED
LED
68uF
0.1
T1
0.1
TX
RX
RECEIVER
SW1B
OUTPUT
EXTERNAL
LOW-PASS
FILTER
ANTENNA
2N2905
10-120p
XTAL
1mH
RFC
470p
2SC2166
100
100
*
33K
KEY
0.1
2N2905
GROUND
Rx=TO SUIT LED
* or 50 SINGLE
T1=FT50-43 11 TURNS 0.5mm ENAM. BIFILAR

Winding T1.

Wind each winding side by side with no cross - overs.

Strip the insulation from the two "centre" conductors closest to each other and verify with an ohmmeter that they are different windings.

Solder them together. You now have a correctly wound bifilar transformer."

Zach Lau, KH6CP/1, Hints and Kinks for the Radio Amateur, 14th Edition.

LAYOUT OF THE JBS TRANSMITTER

Outputs recorded from test JBS Transmitters [worse results quoted] using fundamental crystals and 3 section Low Pass Filter. Harmonic outputs all better than 40dB down.

The voltage required for a 1 watt output is quoted because I only ever use 1 watt of RF power output.

OUTPUT LEVELS FROM THE JBS TRANSMITTER:

BAND	VOLTAGE	POWER OUT	AT ONE WATT LEVEL	
3.5	13.8V	7W	7V	1W
7	13.8V	6.5W	6.9V	1W
10	13.8V	4.5W	7V	1W
14	13.8V	3W	8.5V	1W
18	13.8V	2.8W	10V	1W
21	13.8V	1.9W	12V	1W
24	13.8V	50mW	Running out of steam!	

GM3OXX JUNK-BOX SPECIAL KIT OFFER

Kanga Products are offering a member's special on the JBS
Price for the first 100 JBS Kits ordered is 12.95 [+£2 p/p]
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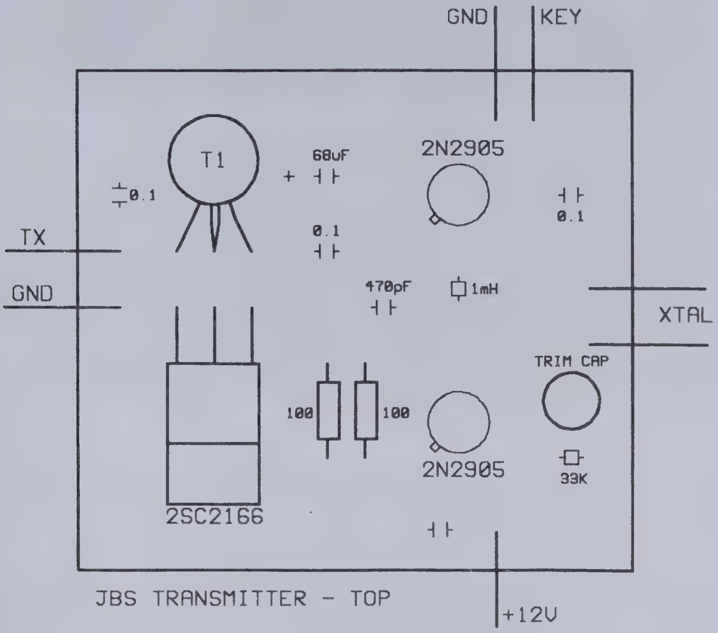
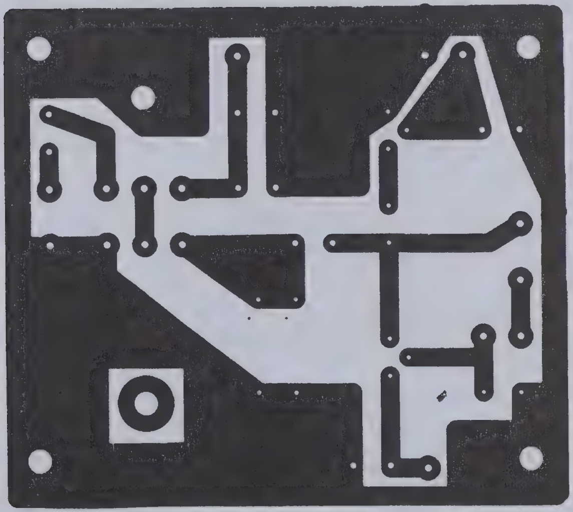
CRETE ROAD EAST, FOLKESTONE, KENT CT18 7EG

JBS TRANSMITTER LAYOUT AND PCB - BOTH VIEWED FROM THE TOP SIDE



JBS TRANSMITTER - TOP



OK2PZL 7/14 MHz Transceiver

Petr Pokorny OK2PZL, Paseky 462, 760 01 Zlin, Czech Republic

A W1FB MEMORIAL AWARD WINNER

The W1FB Award for 1998 has been divide between GM3OXX and OK2{ZL for two excellent entries to the competition

Technical Notes:
The coils for pulling the crystals - I have tried various types. The best results were with a cross - wound coil using the dust core. The only disadvantage was its radiation (o 0.5mm). So. finally. I used an IF transformer coil from on AM transistor radio. which is housed in a metal cover. thus well shielded. RIT - I hope this receiver incremental tuning is rather original. It took me some time to think out the RIT without any additional parts. During receive the voltage (current) on T1 collector is decreasing and making the frequency shift about 1kHz. The diode D causes no voltage on T2 drain. During transmit - key down - the T1 collector gets the full voltage via diode D and the RIT is disabled. I think this idea could also be used to build a RIT with a varicap diode - the full voltage through the diode D - the regulated voltage through a potentiometer - the voltage divider. The 50uF capacitor parallel to the RIT potentiometer prevents the scratches during tuning.

Transistor T2
I tried many IRF types (IRF510. 520. 530 710) and the type BUZ 72. IRT510 seemed the best. but the power output on 14 MHz was only 300 mW.

In some articles on VMOS PAs from W1FB I found notes types VN66 AF and VN88AF. I tried VN66AF and this proved to be the best one. The power output with IRF510 was 1W on 7 MHz and 300 mW on 14 MHz. with VN66 AF it was 1W on both bands. The PA transistor T2 should work in class AB - the efficiency is lower. but at the same spurious should also be lower.

The narrow band matching filter L1. C1 appeared as the only good out of many filters I tried. It removes the unwanted frequencies during transmit. it is better than a simple low pass filter. During receive it helps to reject with the front-end band pass filter

RE2 - the band pass filter switching - I had the relay with only one change - over contact.
RE2 and coils L2. L3 are located directly on the variable capacitor forming a "cube".
Transistor T4 should be the low - noise type (BC 550. BC 413) compared to com on transistors. it really causes noticeable decreasing of noise.

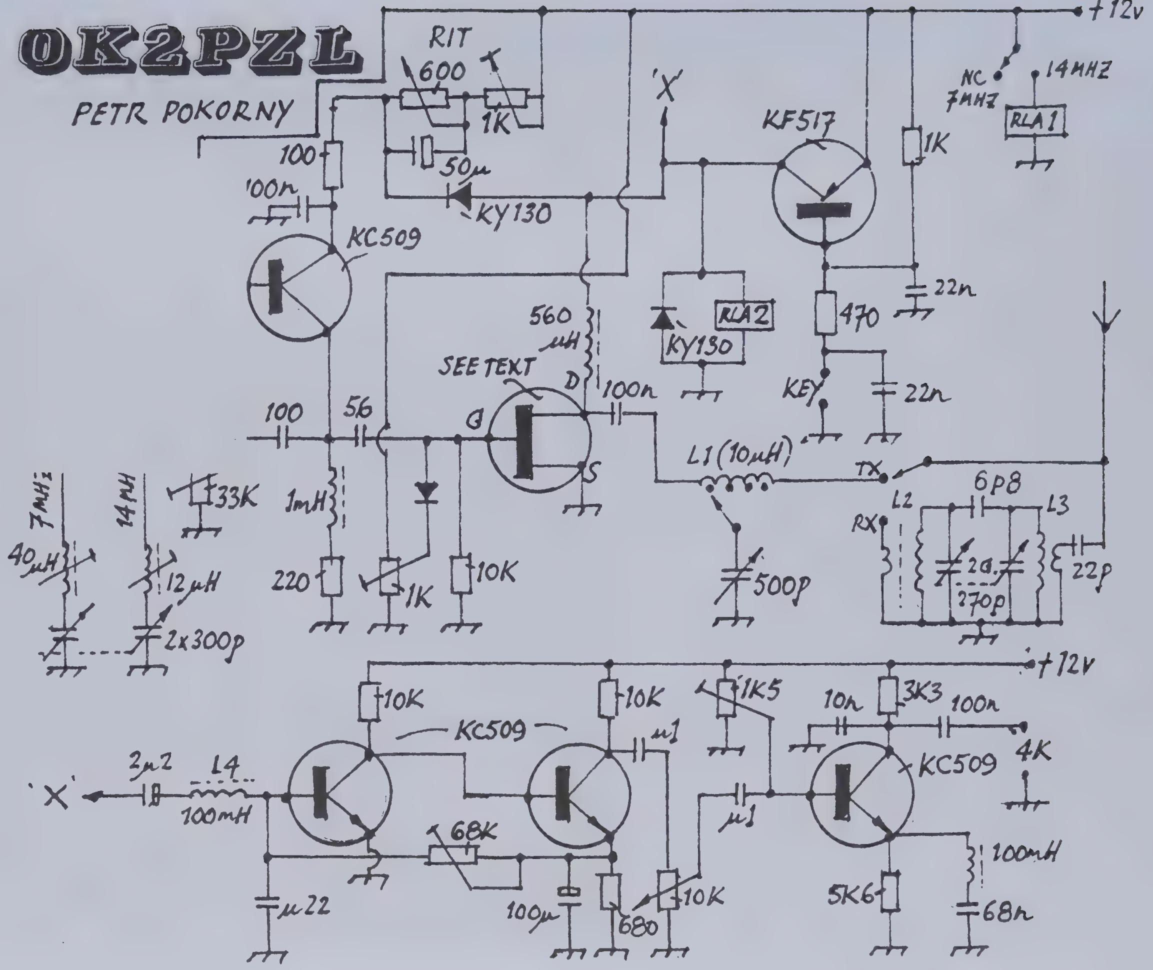
Transistor T6 - capacitor 10 nF in collector prevents the self oscillating of the amplifier in case you build the amplifier like me. that is on a universal board without shielding.

Coil L1 - I have reached the best results with a coil wound on a ceramic former dia 20 mm. 30 turns of wire dia 0.5 mm. with taps. Finally. I used the Amidon toroid core T50 - 2. 50 turns. tap every fourth turn. the inductance about 12uH.
The practical notes.

The full BK operation is an advantage. there is no switching receive/transmit. My first QSO was with OE/DF5KR on 7 MHz. my report was 559 and I used the central heating as an antenna. followed by DF7QH with RST 339. Both stations proved unbelievable patient and I would like to thank them. Later on. I put up an inverted dipole. some 5m up and it was much better. hi - IK. ZU. F. HB. OZ. 4U1. EA etc.

OK2PZL

PETR POKORNY



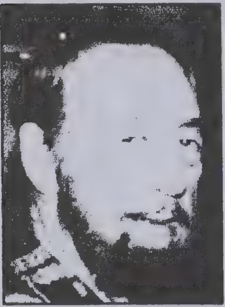
with reports 559. The first QSO on 14 MHz was with OH 5 MKB RST 569. The receiver is very simple, but seems to be quite good. The plans are to build another AF amplifier for the loudspeaker (TDA 7052).

I must say I was inspired by the transceiver FOXX by GM3OXX from sprat and by articles by W1FB on V - MOS transistors. The whole rig is built on a universal board of a postcard size. The front and back panels are soldered to this board. The cover is made from a U shaped tin.

R1 220 ohm. Driving of T2 (0 - 500 ohm)
TL choke, 560uH and higher. During received it lets go through only af signal
R2 1k. adjust for listening at the same freq as transmitting
L1 30 turns on former dia 20mm, tap every third turn
L2, L3 - 3uH. 2 turns/12 turns on a toroid N 05 - - 10mm
L5 together with capacitors M68 forms a simple filter

Transistors:

T1, T4 - T6	KC 509 (any BC type)
T2	VN 66AF (IRF 510)
T3	KF 517
T5	KC50G



The W1FB Memorial Award

The award for 1998 is shared by George Burt, GM3OXX for the JBS Transmitter and Petr Pokorny, OK2PZL.

For 1999, the project is to design **a Simple Receiver for one or more Amateur Bands**, suitable as a construction project for a Novice.
Please submit your design to G3RJV by the last day of November 1999, with circuit sketch, all values and brief notes.
The project will be published in SPRAT
and the winner will receive an engraved plaque.

All Entries to G3RJV

WOULD YOU LIKE TO SPONSOR A MEMBER?

For some years members of the G QRP Club who are not able to pay their own subscription have been sponsored by other members. These include members in third world countries and from countries where currency is not exchangeable. If you would like to sponsor such a member, please contact our membership secretary :

John Leak, GØBXO, Flat 7, 56 Heath Crescent, Halifax. HX1 2PW.

TAKE TWENTY FOR ONE HUNDRED - Circuits for prizes!

The hundredth edition is SPRAT is coming soon! Peter Gant [member 10003] reminded me of the "Take Twenty" series in Practical Wireless some years ago. Each month the series featured a simple circuit for the constructor using twenty or less components. At Peter's suggestion we are inviting members to submit "Take Twenty" circuits. Accepted circuits will be published in SPRAT and the authors will receive a prize! All we require are circuit sketches [include all component values] and brief notes on the projects. **All entries to G3RJV**.

The DL-QRP-PA [9W. on a 1" Board]

Peter Zenker DL2FI, Saarstr 13, BERLIN. D-12161

translation of an article in QRP-Report, the magazine of the DL-QRP-AG

QRP, means 5 Watt carrier output or 10W PEP, at least this is the international definition. This is assumed by many Hams to be not an technical issue, but this is not true as you will see very fast if you have a closer look to the PA of many QRP Rigs.

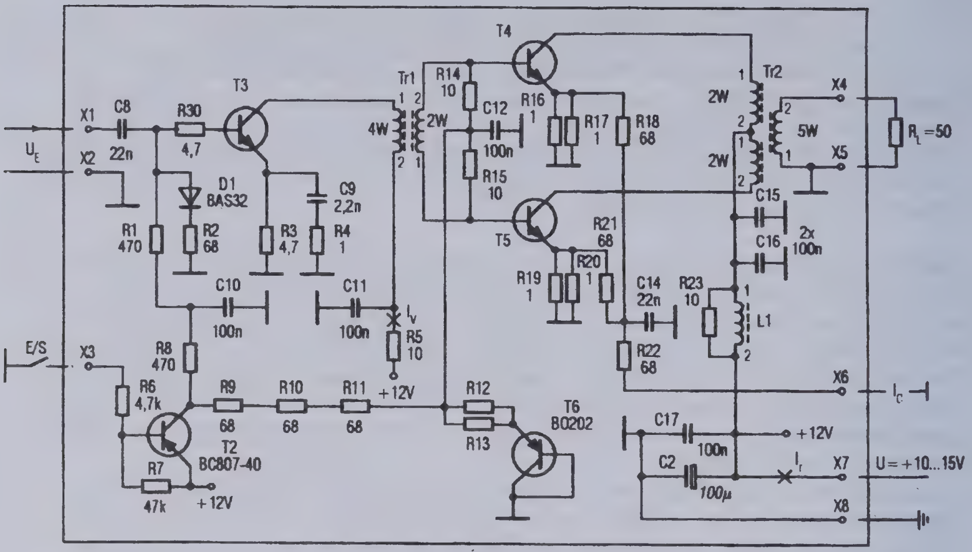
While the homemade QRP-receivers are often high sophisticated, the transmitter part of most QRP-rigs is developed the easy way. As a type of standard normally most constructors use a single step PA. In newer times very often cheap V-MOS switches are used instead of real bipolar RF-Power transistors. To meet the FCC rules, the PA normally is followed by a sumptuous lowpass filter which also very often does not help enough. Hams trying to build their own rigs based on such designs even if they use kits almost never reach the assumed power level especially on the higher frequencies. This results in dozen and dozen of tweaking procedures every time a new schematic or a new kit appears.

In the past I tried several of the tweaking procedures by myself. Following the instructions given by lots of people on the Internet QRP-L or in other Ham Radio publications I tried nearly all published modification for the NorCal40, the SIERRA and some 10 to 15 other rigs. Using simple measurement techniques some of the modifications seemed to work great, e.g. the power of my SIERRA at 28 MHz was more then doubled. Using a high tech Analyzer which I was happy to loan from a friend I had to learn that power is not power. What I had seen on the Dummy Load plus wattmeter was shown at the Analyzer as a broadband noise. In other words, My modified SIERRA produced RF at several frequencies up to the UHF range, but at the desired 28 MHz frequency I found the same output as before.

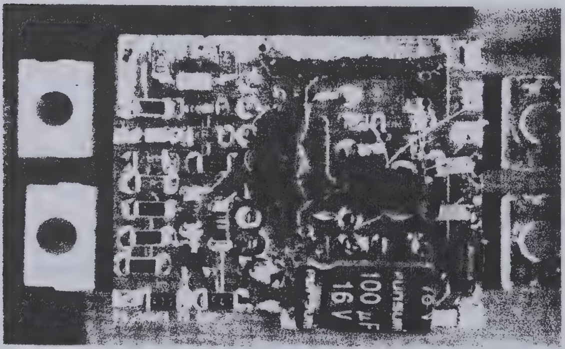
And old law in RF says: If a PA is well designed, every thing in it does what it is designed to do. If the Output transformer is designed to run at 2 Watt level, tweaking it to 5 Watt normally results in extreme increasing harmonics without changing the complete design.

The constructor of the DL-QRP-PA Helmut, DL2AVH is working on this problem since many years. Since the early 80 one main result of his experiments is the knowledge that miniaturizing of semi conductor power amplifiers is a way to go that helps a lot. The reason for miniaturizing is the fact that even in 5W RF-Amplifiers currents are very high. Compared to a 5 Watt Valve PA he calculated that due to the high current the line length of all lines between any two points of a semiconductor PA have to be 600 times shorter then in a valve PA. This could only be realized by using SMD parts. The second result of his experiments was that he now only works on push pull amplifiers concepts. As he says, push pull amplifiers dont need much more expenditure, but give you much better results in terms of harmonics then any other type of PA. Some overloading as it is quite normal in Amateur Radio transmitters causes only very little more harmonics in a push pull amplifier but make a standard PA to be a type of big harmonic gun. Using some of the QRP-PA´s I′ve seen in my lab would give you at least some bad comments by angry friends. While testing such a PA at 3515 kHz my friend DL7ARY phoned in asking me why I not was responding to his call at 7030 kHz where he could hear me with an S7 signal.

Experiments with several V-MOS PAs showed that due to the characteristic of V-MOS it is nearly impossible to get linearity and good harmonic suppression below 28 Volt. At 12 Volt range they can only be used as a switch, but not as a PA for RF.



As a result of his long time experimenting Helmut now presents his RF broadband amplifier devoted to the DL-QRP-AG. It is a push pull PA using a pair of 2 SC1971, designed to give a harmonic level as small as possible, to work absolute stable between 11V and 15V and to give an output level of 9.7 Watt to 7.5 Watt between 1,8MHz and 50MHz. The PA need a driver level of about 200mV to 300 mVand has a gain figure of 37 dB +- 1dB over the entire range of frequency. It is constructed on a double sided PC-board about 1 by 1 inch, using 36 SMD parts, two double hole torroids plus 3 RF Transistors and one constant current source. As a first batch we produced 100 of this PA. about 50 have been sent out in Kit form and the other 50 have been sent out as a kit to members of the DL-QRP club DL-QRP-AG. The response was overwhelming. Although some people had problems with the SMD parts (I personally used an extra big magnifier), not one reported problems on the RF side. In the mean the DL-QRP-PA has been adopted to nearly all known QRP-Rigs. It works absolute great in my SIERRA and in the QRP+ from Index as well. The harmonics of the SIERRA are at least -65 dBC (below carrier) I got response from German White Mountain users which are happy now and it also fits great into a NorCal40.



The PA is now no longer available from the DL-QRP-AG, but it can be purchased as a SEMIKIT from the FUNKAMATEUR Reader Service. (That's a German Amateur Radio Magazine) They offer a kit with all SMD parts already soldered :-) for a very reasonable price. You can order the PA using the Internet shop at http://www.funkamateur.de. The shop is partially English language, prices are in $US and you can use your credit card.

'Penning Down' Crystals

**Richard Wells G0RXH 33 Sandholme, Steeple Claydon,
Buckingham, MK18 2QE. E-Mail Richard.A.Wells@btinternet.com**

'Penning down' crystals is not some new company but a method I have been using for some time to physically lower the frequency of quartz crystals.

The major cost of simple vxo QRP rigs has got to be that of the crystal and you may even want two or three 'rocks' for various frequencies, by using cheap 3.5794MHz and an indelible pen I have made a good collection of 80m crystals (Small can size)

The requirements for the penning down are simple, firstly a 3.5794MHz crystal (obviously!, but more on the types later), an xtal oscillator circuit and a method of measuring the crystals frequency e.g. frequency counter or 80m rx ,lastly you will need an indelible fine tipped pen.

Probably the trickiest part is actually opening the crystal up, and as there are three ways the manufacturers seal the cans to the base it pays to be able to recognise the different types. Fig 1 shows a welded type and this can be cold or resistance welded, the type numbers are HC-43/u and HC49/u and the only way to open them up is by carefully cutting around the can just above the base with a junior hacksaw or a hobby drill will a cutting disk, I must say that this is a very precarious task and is not for the faint hearted, after destroying about five crystals I managed to get it right!

Fig 2 shows the soldered type and this is by far the most easiest to work with, types are HC-25/u and HC-18/u. and all that is required with these is to apply a soldering iron to the clearly visible join and remove the can. Once the can is removed from the base you should have something resembling Fig3, the clear disk is the quartz crystal itself suspended between two wires, this is VERY delicate and you should never touch it, always handle the unit by the pins or base, I personally place the crystal in the oscillator circuit and then unsolder the can so avoiding any possible contact.

This is now where the fun starts, power up your oscillator and you should see a frequency of 3.579MHz on your counter, using your fine tipped indelible pen touch it onto the silver coloured centre of the quartz disk, and hey presto one of two things should have happened, either your crystal has died (very unlikely at this stage) or the frequency has begun to lower. A little at a time is what is required for success, small dots are the best method and a careful eye on the output frequency to ensure oscillation continues.

At times the crystal may die but wait a few moments for the ink to dry and it should spring to life again, if you can't get it to restart then you can start again by using a cotton bud soaked in surgical spirit or similar to clean the ink off, but use very light pressure or the crystal will break.

You should find it no problem to get to frequencies as low as 3.560MHz but you will find it hard to get exact frequencies e.g. 3.565000MHz (but what's a few kHz between friends) ,when your happy with your new crystal you can solder the can back on, this will change the frequency very slightly by a few tens of Hz, and there you have it, a homebrew rock for your homebrew rig.

Having used penned down crystals for over two years I have seen no adverse effects, the frequency never moves and the things never fail to start, I even have a 12MHz one in a 2m rig I use for packet! The only problem I have found is when I tried to lower the frequency of a 2Mhz clock crystal (large can size) this would only move down 5khz after vigorously 'painting' both sides of the quartz crystal with ink!

It would be interesting to hear from other members how they get on with this idea and how low/accurate they can 'pen down those rocks'.

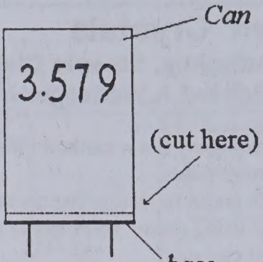


Fig 1.

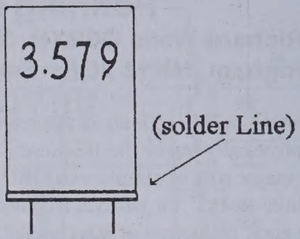


Fig 2.

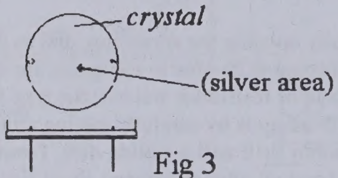
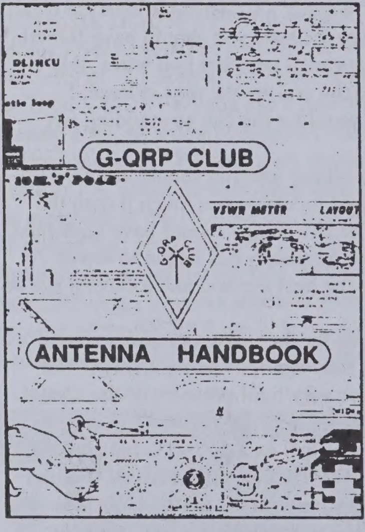


Fig 3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PICKETTS LOCK RADIO RALLY – 27 & 28 November 1999

It is hoped that the club will run a stand at this event in the late autumn.
We are looking for a few members to volunteer to staff the stand on the two days of the event. The stand depends upon on help of members.
If you can help please contact

DICK PASCOE G0BPS, SEAVIEW HOUSE,
CRETE ROAD EAST, FOLKESTONE. KENT CT18 7EG

The G QRP Club

The G-QRP Club, was founded in 1975 and now has some 5000 members world-wide. The club exists to promote interest and growth in low power amateur radio communication (five watts or less). Membership is open to any licensed radio amateur or short wave listener anywhere in the world.

The club publishes a quarterly journal called *SPRAT*, which is sent free to members. *SPRAT* contains many circuits, technical hints and ideas for QRP construction projects, together with club news, contest and award information and other items of interest to QRP operators. *SPRAT* is an exclusive QRP journal and contains much practical information in each issue.

A datasheet service is provided free to club members. The sheets cover articles of QRP interest, many from overseas magazines, which are too long, or specialist, to appear in *SPRAT*.

The club issues a number of operating awards to licensed and SWL members, most of them unique. Full details are supplied in the members' handbook.

The club runs its own internal QSL Bureau, through which cards can be interchanged between members. From time to time the club makes 'Special Offers' of components, printed circuit boards etc. for members at reduced prices. A full range of club insignia items is available including badges, stickers, keyfobs and medals.

QRP club activity takes place on the International QRP Frequencies (3560, 7030, 10106, 14060, 21060 and 28060 kHz). Special 'Activity Weekends' are held at least twice a year, and at the end of December a 'QRP Winter Sports' is promoted. The activity periods attract worldwide support. The club also supports other international QRP contests and activities.

The address of the Secretary is:
Rev. George Dobbs G3RJV, St. Aidan's Vicarage,
498 Manchester Road, Rochdale, OL11 3HE.

Details of membership and a sample of *SPRAT can be from:*
Mr. John Leak G0BXO, Flat 7, 56 Heath Crescent,
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Low Power Scrapbook

Hundreds of the very best projects from the G-QRP Club's magazine Sprat are brought together in this handy book. Includes low power transmitters, simple receivers, accessories, circuit and construction hints and antennas.

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